Louisiana Department of Wildlife and Fisheries

Office of Fisheries

OYSTER STOCK ASSESSMENT REPORT

OF THE

PUBLIC OYSTER AREAS IN LOUISIANA

SEED GROUNDS and SEED RESERVATIONS

Oyster Data Report Series

No. 17

July, 2011

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Cover Photo: Shoveling oysters to be taken to market. Courtesy of *The Louisiana Conservationist*.

Publication of the 2011 Oyster Stock Assessment Report was delayed due to limited agency resources as a result of the *Deepwater Horizon* Oil Spill. The Report, although published in 2012, covers the time period between August 2010 and July 2011.

Statewide Overview - 2011 Oyster Stock Assessment

Introduction

The oyster resource in Louisiana is one of the largest and most valuable in the nation. Its value is derived from both the economic benefits it provides to the state and the ecological benefits it provides to the estuarine environment. Due to Louisiana's vast coastal wetland area, ample habitat exists where oysters thrive under a variety of environmental conditions. The Department of Wildlife and Fisheries (LDWF) is charged with managing the oyster resource on the public grounds by closely monitoring the size and health of oysters on nearly 1.7 million acres of public water bottoms. Oyster management on these public grounds includes activities such as setting oyster seasons, monitoring harvest levels, and cultch planting (reef building) projects (Figure 1).

Figure 1. Cultch planting activities in Black Bay (Plaquemines Parish) during May 2009. Limestone rock is being washed overboard using high-pressure water cannons and unloaded using a clam bucket and crane.

Typically, the oyster industry utilizes the public oyster grounds as a source of seed oysters (< 3") for transplant to private leases. The public grounds also yield a supply of sack-sized oysters (≥ 3") and these oysters may be taken directly to market. The manner in which both the public grounds and private leases are utilized in combination helps to keep Louisiana's industry as a national leader in oyster production with annual value typically in excess of $35 million worth of dockside sales.

Oysters also play an important ecological role in the estuarine ecosystem. Oyster reefs provide the majority of hard substrate required by other sessile invertebrate species such as barnacles, bryozoans, tunicates, and anemones. Reefs are also utilized as shelter and forage habitat for many species of crabs, worms, fish, and meiofauna. Estuarine water quality can be affected by the filter-feeding activities of oysters, and reefs may also play a role in stabilizing shorelines.

Louisiana Oyster Landings

Oysters have been a part of the Louisiana economy for many years; starting from meager beginnings and growing into a multi-million dollar industry. Louisiana regularly leads the nation in the production of oysters and accounted for an average of 35% of the nation's oyster landings over the 1999 – 2009 time period (Figure 2). Although Louisiana was the top producer of

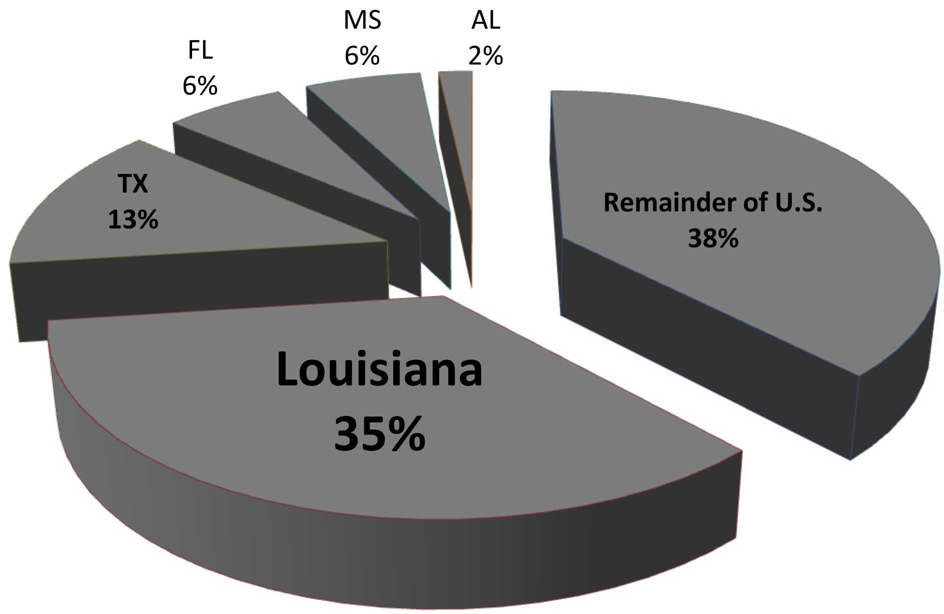
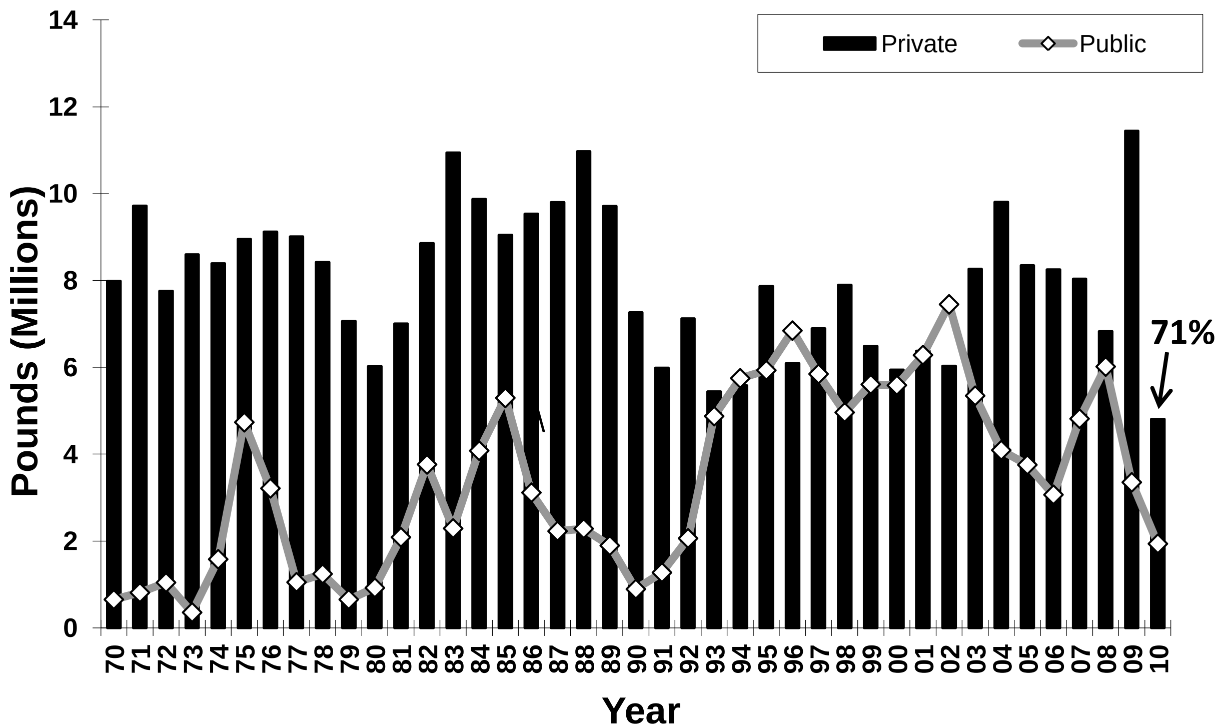


Figure 2. Percent of total landings (1999 – 2009) of all species of oysters based on pounds of oyster meat (Data source: NMFS).

American (=Eastern) oysters in 2009 with landings of approximately 14.0 million pounds of oysters (*Crassostrea virginica*), preliminary trip ticket data for 2010 indicate that oyster landings were among the lowest on record at approximately 6.7 million pounds. This is only the third time since 1950 that Louisiana has landed less than 7 million pounds and the lowest annual landing since 1966. Among Gulf of Mexico states, Louisiana consistently ranks #1 in landings accounting for over 50% of all oysters landed.

The public oyster grounds can be considered the backbone of the Louisiana oyster resource. These grounds are a valuable contributor to overall Louisiana oyster landings each year, while also supplying seed oysters transplanted to private leases for grow-out purposes. The trend from 1970 – 1992 showed the majority of Louisiana oyster landings came from private reefs. From 1992 to 2001, however, the public ground stock size increased, in general, and landings from the public grounds increased as well. In 2008, harvest levels significantly increased on the public grounds over 2007 levels and the public grounds produced approximately 47% of all oyster landings for the calendar year. This reliance on the public grounds reversed in 2009 and 2010. Harvest data showed that 71%, of all oysters landed in Louisiana came from private leases (Figure 3).



Note: Long-term average (1961 to 2010) for private landings is 8.012million pounds. LTA for public landings is 3.049 million

Figure 3. Historical oyster landings from public grounds and private leases in Louisiana.

When comparing the price per pound of oysters on public grounds and private leases, it is clear that public ground oysters hold their value well as compared to oysters from private leases. In 2010, public ground oysters fetched $3.72 per pound at the dock while private lease oysters valued slightly less at $3.59 per pound. Overall average price per pound for all Louisiana oysters in 2010 ($3.62) rose for the second consecutive year compared to 2008 ($3.03) and 2009 ($3.34) according to preliminary LDWF Trip-Ticket data. This increase in the value of oysters at the dockside could be attributed to a lack of supply due to extensive closures of oyster harvest areas surrounding the *Deepwater Horizon* oil spill. Nationwide 2010 landings data from the National Marine Fisheries Service (NMFS) were not available during the time period covered by this report but will be included in the Oyster Stock Assessment Report for 2012.

Statewide Oyster Stock Assessment Overview

Methods

Each summer, LDWF biologists from each Coastal Study Area (CSA) of the Fisheries Division perform quantitative evaluation of the oyster resource on the public oyster areas. This biological evaluation includes using SCUBA to collect oyster samples from within a square meter frame from multiple locations (sample stations) in each public oyster ground. At each station, five replicate square-meter samples are collected and data is combined to produce average numbers of spat, seed, and sack oysters per station. Spat are young oysters measuring one to 24 millimeters (mm) in length. Seed oysters measure 25 to 74 mm and sack (= market-size) measure 75 mm and above. The numbers of oysters per station is then multiplied by the reef acreage to obtain an estimate of the total amount of oysters present on the reefs. Sampling that is undertaken as part of the annual stock assessment plays a valuable role in predicting the success of the upcoming oyster season, which generally opens in early September and runs through April of the following year (although the season may be closed or delayed if biological concerns or enforcement problems are encountered). This stock size information is used to make recommendations to the Wildlife and Fisheries Commission for the setting of the oyster season.

Sampling in 2011 significantly increased compared to previous years as many new stations were incorporated into the sampling program. Overall, sampling increased from approximately 350 samples to approximately 490. Replication was increased from three samples per station to five during the 2010 stock assessment project to provide a higher level of accuracy in determining oyster availability on each reef. The additional sampling of 5 replicates per sampling station was continued in 2011.

Due to recent realignment of the CSAs, changes to CSA designation must be noted. Coastal Study Area 1 and 2 were combined and are presented as North Pontchartrain Basin (CSA 1 North) and South Pontchartrain Basin (CSA 1 South - formerly CSA 2). Additionally, CSAs 4 and 5 were combined and are presented as a combined Terrebonne Basin report (page xii).

Side-Scan Sonar Projects

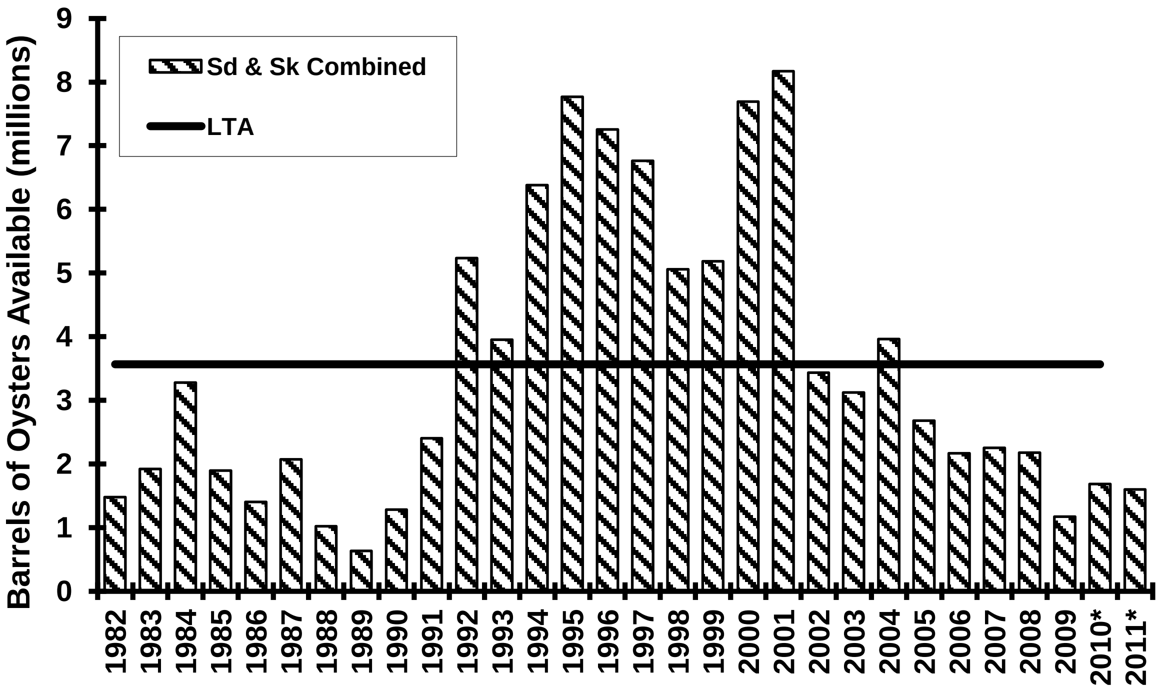
Water bottom assessments continued in 2010 and 2011 to update reef information (size and aerial extent) on selected portions of the public oyster seed grounds. Nearly all of the public oyster seed grounds in the Breton Sound basin (CSA 1 South) were evaluated using side-scan sonar technology. Additional areas within Calcasieu Lake (CSA 7) were also side-scanned and reef information was updated. These projects join a long list of water bottom assessment projects completed over the last three years including portions of Mississippi Sound, Drum Bay, and Morgan Harbor in CSA 1 North (St. Bernard Parish) and portions of Calcasieu and Sabine Lakes in CSA 7 (Cameron Parish). Reef acreage in Drum Bay, Morgan Harbor, and Sabine Lake was unknown until completion of these projects, while the recent side-scan of the Breton Sound basin updated reef acreage and location information last produced in 1977. All reef information, with the exception of the Breton Sound basin, has now been incorporated into the LDWF oyster management program, and is included in the respective stock assessment reports on the following pages. Additionally, mapping projects are needed within CSA VI (Vermilion Bay area) so that reef acreage can be obtained in order to provide a true estimate of oyster stock availability in that system.

Annual Stock Size

The statewide oyster stock size in 2011 has shown a slight decrease compared to 2010 as approximately 1,597,420 barrels of oysters are available on the public oyster areas of Louisiana this year (Figure 4,

Table 1. Estimated Statewide oyster stock size on the public oyster areas of Louisiana. CSA denotes Coastal Study Area. Percentage columns (%) indicate percent of statewide total. Data in barrels and 1 barrel = 2 sacks.

CSA	Seed	Seed %	Sack	Sack %	Total	Total %
1 N	33,691	6.0%	27,057	2.6%	60,748	3.8%
1 S	16,148	2.9%	68,725	6.7%	84,873	5.3%
3	18,341	3.2%	2,955	0.3%	21,296	1.3%
5 E	11,570	2.1%	3,146	0.3%	14,716	0.9%
5 W	102,350	18.1%	102,617	9.9%	204,967	12.8%
7	383,953	67.8%	826,867	80.2%	1,210,820	75.8%
Total	***566,053***		***1,031,367***		***1,597,420***	

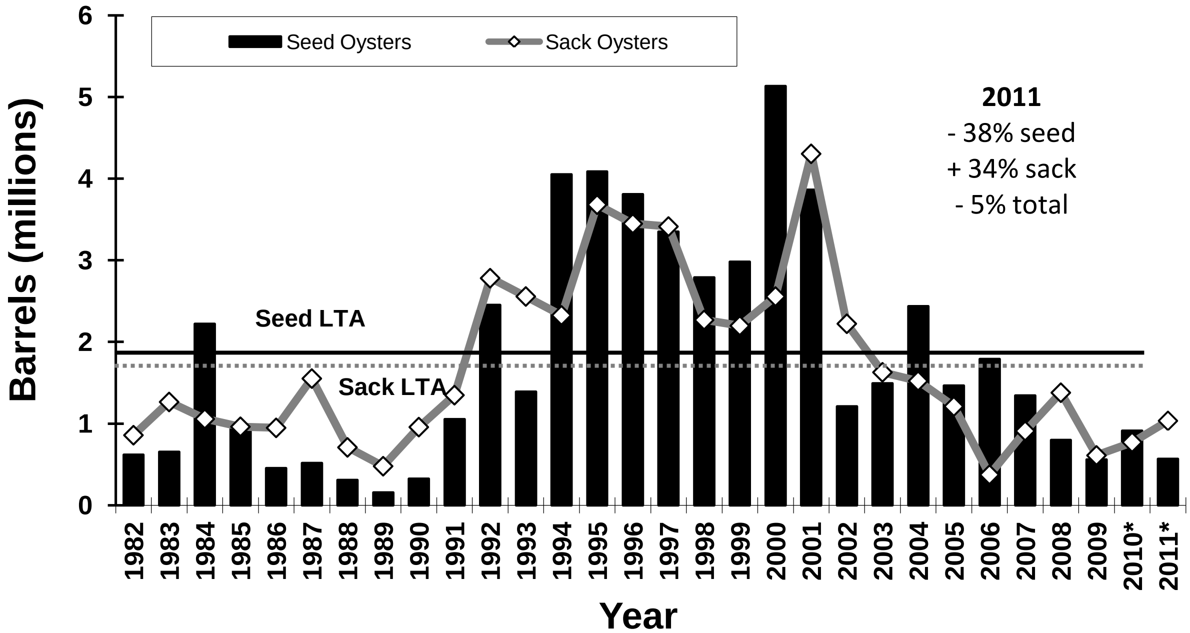


NOTE:1994-2004 includes CSA I data revision
* 2010 to present data includes Sabine Lake data.

Figure 4. Historical oyster stock size on all public oyster areas combined. LTA denotes long-term average.

Table 1). The 2011 oyster stock size represent an approximate decrease of 5.0% (-84,655 barrels) over 2010 levels and total stock is largely influenced by oyster stocks in Calcasieu and Sabine Lakes (CSA 7). Although the 2010 oyster stock assessment report did not include Sabine Lake, an oyster stock assessment was performed in that public oyster area in August 2010 (following the publication of the 2010 report). Stock size information from that assessment is included in all 2010 information presented herein. Statewide seed oyster availability dropped approximately 38% as compared to 2010 levels, while market-size availability increased approximately 34% (Figure 5).

Data generated from the 2011 oyster stock assessment sampling yielded continued troubling results both on a statewide level and within several CSAs. The historic primary public grounds east of the Mississippi River showed drastic decreases in oyster stock abundance with CSA 1 North (Lake Borgne, Mississippi Sound, etc.) falling approximately 72% to its lowest point in over 20 years. Unfortunately, successful spat sets in the fall of both 2009 and 2010 in CSA 1 apparently did not survive as seed abundance dropped to less than 34,000 barrels and sack stocks decreased to just over 27,000 barrels. Similar decreases were observed in seed oyster stocks in the Breton Sound basin (CSA 1 South) with a drop of nearly 85% as compared to 2010 levels. There was, however, an increase in the availability of market size oysters in CSA 1 South of approximately 73% to 68,725 barrels. (Table 1). The average size of animals collected during the



NOTE:1994-2004 includes CSA I data revision
* 2010 to present data includes Sabine Lake data.

Figure 5. Historical Louisiana oyster stock size on the public oyster areas. LTA denotes the long-term average of 1982 - 2010.

2011 oyster stock assessment sampling in CSA 1 South were nearly four inches in length, indicating that very few spat and seed-size oysters exist in this area.

Coastal Study Areas 3 and 5 East (formerly CSA 4) showed significant increases both seed and sack stocks. Although the overall oyster stock size remains low in Hackbery Bay (CSA 3), significant increases were noted in both seed (+265%) and market-size (+145%) oyster abundance. Similarly, Lakes Chien and Felicity (CSA 5 East) increased in overall stock abundance in 2011 as compared to 2010 with the majority of the oyster stocks contained in the seed-size category (approximately 12,000 barrels, Table 1).

Significant increases in market-size oyster stocks (+181%) were noted in CSA 5 West (Sister Lake, Lake Mechant, Bay Junop), although a 34% decrease was found in seed oysters. Calcasieu Lake showed modest gains in sack oysters on the east side where stocks of market-size oysters rose slightly to just over 27,000 sacks. However, decreases in both seed and market-size oysters in West Cove of Calcasieu Lake resulted in the overall oyster stock abundance dropping by approximately 13%. As with past stock assessments, the highest stock densities within each CSA were generally found on recent cultch plants such as the 2009 cultch plant in Sister Lake (CSA 5 West).

<u>Factors Affecting the 2011 Oyster Stock Assessment</u>
A variety of factors, both natural and anthropogenic, affect the oyster stock size on the public grounds in any given year. Natural threats to oyster survival include extreme low salinities

caused by high river discharge and localized rainfall, as well as predation and disease typically associated with periods of high salinity and high temperature. Construction activities (e.g. oil and gas production), harvest and environmental perturbations (e.g. hurricanes) can also impact oyster abundance.

One significant event impacting a large portion of the coastline and oyster resources was the *Deepwater Horizon* oil spill. The BP Deepwater Horizon drilling rig exploded in the Northern Gulf of Mexico on April 20, 2010, approximately 40 miles southeast of the mouth of the Mississippi River. The rig subsequently sank, damaging the well head and associated well structures at the ocean floor. This resulted in the release of millions of barrels of oil into the Gulf of Mexico impacting many coastal areas of Louisiana. In direct response to the threat of oil entering coastal marshes, Louisiana released freshwater from diversions and siphons along the Mississippi River in 2010. Research continues on the ongoing impacts of oil and freshwater releases to Louisiana's near shore environment, including to oysters and oyster habitat.

Environmental Conditions

Scientific research indicates that reproduction of oysters becomes limited as salinities drop below seven parts per thousand (ppt). Additionally, salinities below five ppt coupled with water temperatures above 23^{o} Celsius has been documented to cause significant oyster mortalities. As depressed salinities continue into the hotter summertime months, physiological stress on oysters increases and mortalities can occur. This is a somewhat regular occurrence in areas such as the Vermilion Bay system (CSA 6), but can also occur periodically in other areas of Louisiana's public oyster grounds.

The 2011 freshet (period of increased freshwater input) occurred during the late spring and early summer of 2011. Freshwater entered Lake Borgne/MS Sound (CSA 1 North) via the Bonnet Carre' Spillway which was opened for the second time in four years (2008, 2011). A high Mississippi River also prompted the opening of the Morganza Spillway, which provided additional fresh water into the Atchafalaya basin (CSA 6). This basin was also receiving large amounts of fresh water inputs from a high Atchafalaya River. River flooding entered CSA 1 South via the Bohemia Spillway and through wrap-around freshwater flow via the main delta of the Mississippi River. During this period of high fresh water input, corresponding drops in salinity were noted in many areas of the primary public oyster grounds of the Black Bay area. Elevated oyster mortalities were observed in LDWF dredge sampling, which occurred in the months and weeks prior to stock assessment sampling. Reduced oyster abundance observed in the 2011 oyster stock assessment may be due, in part, to those documented mortalities occurring prior to stock assessment sampling.

Oyster Reproduction and Larval Recruitment

The ability of a species to produce successful offspring is critical to long-term sustainability of the population. Oysters are broadcast spawners, and release millions of gametes (eggs and sperm) into the water column when environmental conditions are conducive to reproduction. This reproductive activity typically peaks in coastal Louisiana, cued mainly by water temperature changes, in the spring and fall of each year.

LDWF biological sampling since the spring of 2010 has shown troubling indications of reproductive failures in some areas. While successful spat sets (the settlement of oyster larvae onto a suitable surface and the metamorphosis of those larvae into baby oysters, called spat) were noted in the fall of 2010 in portions of CSA 1 North, significant numbers of seed oysters were not found in the 2011 stock assessment sampling, suggesting a high incidence of spat mortality at some point since the fall 2010 reproductive event. Additionally, very few spat have been collected in CSA 1 South samples since the fall of 2009. This area experienced very little

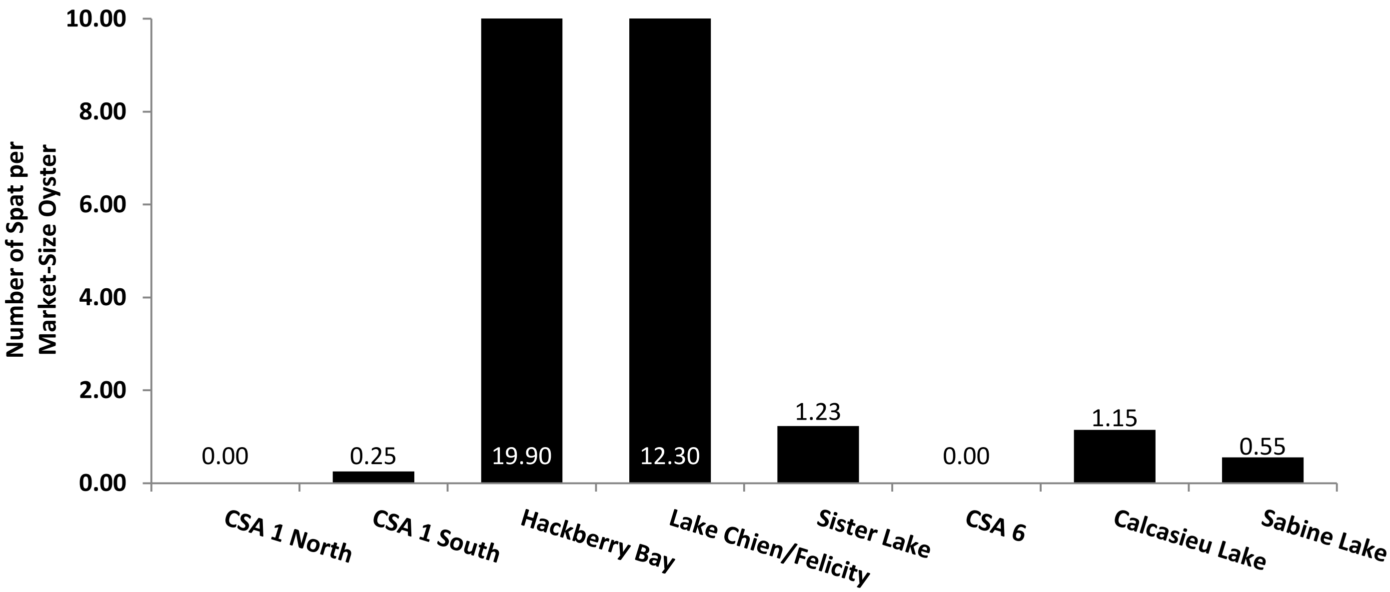


Figure 6. Spat-to-market ratios for oysters collected on various public oyster areas in Louisiana during the 2011 oyster stock assessment sampling. Actual ratios are indicated above/within each data bar.

spatfall in the spring and fall of 2010, and the 2011 stock assessment samples located only 16 total spat in 155 replicate samples indicating poor larval recruitment success in the spring of 2011, likely due to the affects of the *Deepwater Horizon* oil spill and response efforts. CSA 3 (Hackberry Bay) also showed very little larval recruitment during the fall of 2010, again likely due to the oil spill and related response actions, but a successful spatset was documented in this area during 2011 oyster stock assessment sampling.

Reproductive success varied widely among the CSAs, as evidenced by spat-to-market ratios (Figure 6) from the 2011 oyster stock assessment sampling. Strong reproductive output was achieved in CSA 3 (Hackberry Bay) and CSA 5 East (Lake Chien/Felicity), and greater than one spat was produced per market-size animal in CSA 5 West (Sister Lake) and CSA 7 (Calcasieu Lake). Poor reproductive success was noted east of the Mississippi River (CSA 1 North and South) as well as in CSA 6. These areas were influenced by the high Mississippi River in the spring of 2011 as corresponding decreases in salinity were documented during the flooding event. For those CSAs within the area impacted by the *Deepwater Horizon* oil spill, the lack of reproductive success may be a result of the oil spill and response actions.

Commercial Harvest

Estimated commercial harvest pressure was especially low during the 2010/2011 oyster season (Table 2) as documented by LDWF boarding report data. The small harvest was directly impacted by a complete closure of public grounds east of the Mississippi River for much of the season in response to the 2010 *Deepwater Horizon* oil spill. A short season in the Lake Borgne/MS Sound area was opened in May 2011 in front of freshwater provided by the Bonnet Carre' Spillway opening, but overall harvest was only estimated at approximately 10,000 barrels (Table 2). The most significant commercial harvest occurred in Calcasieu Lake (CSA 7). Harvest was once again strong in this area, likely driven by the scarcity of available oysters and fishing opportunities on other public oyster areas as a result of the oil spill, and was estimated at nearly 83,000 sacks (Table 2).

Table 2. Harvest estimates for the 2010/2011 oyster season on the public oyster grounds of Louisiana. Data derived from fisheries dependent surveys of harvesting vessels (=boarding reports) and <u>not</u> from LDWF Trip-Ticket data (except CSA 7). Percentages in parentheses indicate change from 2009/2010. 1 barrel = 2 sacks.

CSA	Seed Oysters (barrels)	Market Oysters (sacks)	Total (barrels)
1 North	10,000	0	10,000
1 South	0	0	0
3	0	0	0
5 East	1,008	610	1,313
5 West	0	217	1,888
6	0	3,775	0
7	0	82,896[1]	41,448
Total	***11,008 (-92.8%)***	***87,498 (-81.7%)***	***56,649 (-85.5%)***

<u>Recent Legislation</u>

The 2011 regular legislative session included several bills filed with direct ties to oysters (Table 3). One of the most notable was SB 73 which effectively produced a limited-entry scenario for commercial oyster harvest in Calcasieu Lake. This bill, which became Act 329, requires a permit to fish the lake and allows only 126 permits to be issued each year by LDWF.

<u>Conclusion and Acknowledgements</u>

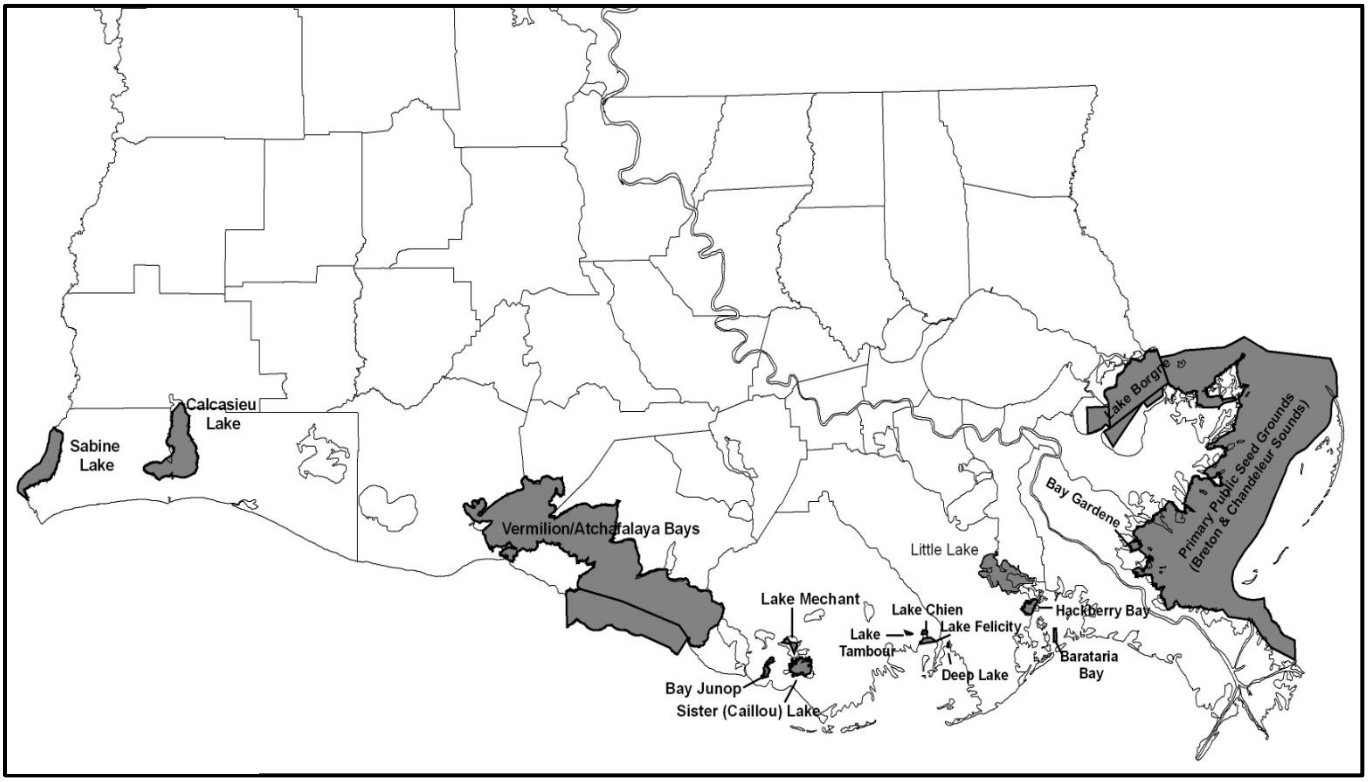
The following report includes both biological stock assessment and historical oyster landings data from each CSA in Louisiana (CSA map depicted on page xiv), as well as a brief report on the most recent oyster season in each area. Biological data was generated from quantitative square-meter sampling (see above) and landings data was generated from field boarding runs and trip ticket information. Countless hours were spent by the field biologists of each CSA, especially in light of this year's increase in sampling effort. Additionally, Ty Lindsey, Felixcia Blanchard, and Denise Kinsey greatly assisted with editorial review and preparation of this document. The efforts of both the field and office staff are greatly appreciated as this report could not be produced without the hard work and dedication of these many people. Questions and/or comments can be directed to Patrick Banks at pbanks@wlf.louisiana.gov.

[1] Data for CSA 7 (Calcasieu Lake) harvest obtained using LDWF trip-ticket data and not fisheries dependent surveys.

Table 3. Legislation proposed during the 2011 Louisiana legislative session.

Bill	Legislator	Description	Passed?	Act #	Effective Date
HB 245	G. Jackson	Requires oysters harvested from in-state waters that are to be sold for raw consumption within the state between May and October must be put in refrigeration no more than five hours after harvest.	Yes	1	5/20/11
HB 246	Simon	Designates the cabochon cut gemstone, derived from the *Crassostrea virginica* mollusk (American or Eastern Oyster) as the official state gemstone.	Yes	232	8/15/11
HB 293	Dove	Requires a vessel monitoring system (VMS) for vessels taking oysters for commercial purposes under the authority of the Oyster Seed Ground Vessel Permit.	Yes	266	8/15/11
HB 301	Billiot	Establishes a standard measurement of the common volume units used in the oyster industry.	No. Stalled in committee	n/a	n/a
SB 73	Morrish	Creates the Calcasieu Lake Oyster Harvester Permit. LDWF shall issue 126 permits annually on a first-come-first-served basis.	Yes	329	6/29/11
SB 240	Chabert	Holds parties harmless from claims for damages done to leased water bottoms as part of conservation, coastal protection, or restoration efforts.	No. Stalled in committee	n/a	n/a
SCR 18	Morrish	Requests OCPR and LDWF to jointly study shoreline protection, effects on marine species diversity and habitat quality, and economic and other ecosystem service values of the Sabine Reef.	n/a Filed with Sec. of State	n/a	n/a

Public Oyster Areas



Public Seed Grounds*

- Lake Borgne
- Chandeleur/Breton Sound
  (Primary Public Oyster Seed Grounds)
- Barataria Bay
- Little Lake
- Deep Lake
- Lake Chien
- Lake Felicity
- Lake Tambour
- Lake Mechant
- Vermilion/Cote Blanche/Atchafalaya Bays

Public Seed Reservations**

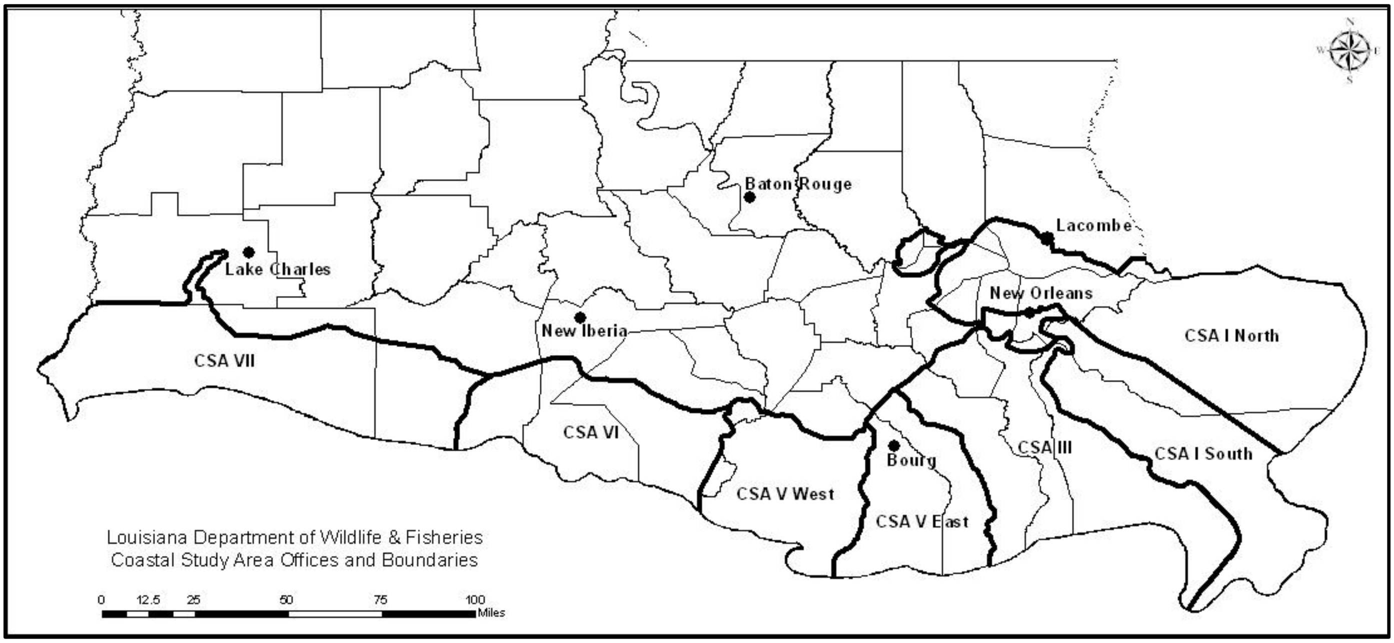
- Bay Gardene
- Hackberry Bay
- Sister (Caillou) Lake
- Bay Junop

Public Oyster Areas**

- Calcasieu Lake
- Sabine Lake

*Seed grounds are designated by the Louisiana Department of Wildlife and Fisheries Commission
**Seed reservations, Calcasieu Lake, and Sabine Lake are designated by the state legislature

LDWF Fisheries' Coastal Study Areas (CSAs)



North Pontchartrain Basin (CSA1N) – Oyster Stock Assessment

Introduction

The public oyster areas within the North Pontchartrain Basin (formerly CSA1) consist of approximately 690,000 water bottom acres and are located in the Louisiana portion of Mississippi Sound, Lake Borgne, Chandeleur Sound and adjacent waters. These areas have historically been used by both Louisiana and Mississippi fishermen, and have recently been areas of high oyster production within the state of Louisiana. Although some of the area was managed as public oyster seed grounds by the State for many decades, the majority of this area was designated by Louisiana Wildlife and Fisheries Commission rule as public grounds in 1988. Much of Lake Borgne was later added as a public oyster seed ground in 1995 and was expanded in 2004. The Department also continually expands and enhances the public oyster reefs through the placement of cultch material (i.e., shell, limestone, crushed concrete) on suitable water bottoms. The most recent plants were in 2007, 2009 and 2011

Currently, these areas are managed in an effort to balance the economic opportunity of the fishery with the long term biological sustainability of the resource. This management is contingent upon obtaining and utilizing the best fishery dependent and independent data available. This includes monitoring the harvest and resource availability throughout the fishing season and performing yearly stock assessments. The information these data provide allow resource managers to implement management changes to both effectively utilize the current resource as well as protect long-term viability. This report will fulfill one of those data needs by providing estimates of the current stock size of the oyster resource within this Basin.

Methods

Samples were taken between July 18 and July 21, 2011 using a one square-meter frame placed directly on the bottom. Divers removed all enclosed live and dead oysters, as well as shell, by hand. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. A total of 16 stations were visited with five square-meter replicates taken at each station except for the Shell Point cultch plant (= 2009 cultch plant). At the Shell Point cultch plant, five $0.25m^2$ replicates were made. The average of the replicates was then pooled within reef systems. This average density per reef system was multiplied by the total area of the same reef system. The resulting number was adjusted into a barrel unit of measure where one barrel equals 720 seed-sized oysters or 360 market-sized oysters. Seed oysters are those measuring between 25 and 74 mm with market oysters being greater than 74 mm. Spat oysters are those 24mm and less. The Lake Borgne Public Oyster Seed Ground was not sampled due to a lack of reef acreage information.

Results and Discussion

Seed and Sack Stock

The current stock size for the North Pontchartrain Basin is estimated at 33,691 barrels (bbls) of seed-size oysters and 27,057 bbls of market-size oysters. These numbers include all of the currently assessed reefs and the 2009 Shell Point cultch plant (Figure 1.1). Comparing with last year's assessment, there was a 72% decrease in the seed-size estimate and a 72% decrease in the sack-size estimate.

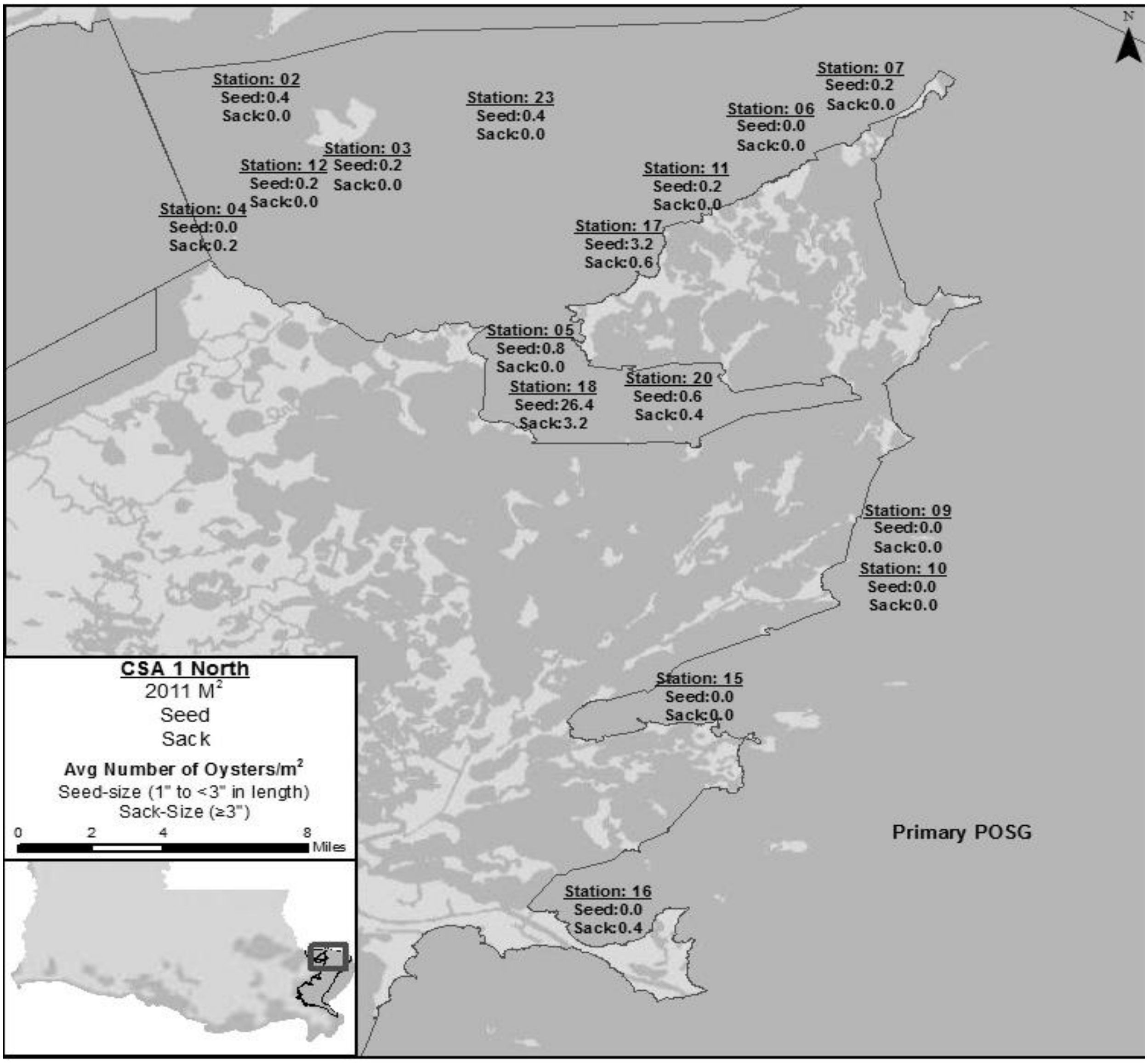


Figure 1.1. Map showing North Pontchartrain Basin oyster stock assessment stations within the Mississippi and Chandeleur Sounds. Numbers below stations are average numbers of seed (SD) and sack (SK) oysters per m^2.

Oyster density and abundance were not evenly distributed among areas (Table 1.1) with the highest density estimates of seed and sack oysters at the Shell Point cultch plant. Highest overall abundances of seed and sack oysters were in the Three-Mile/West Karako and Morgan Harbor areas, respectively. It is important to note variability both within and among stations when comparing estimates, especially given small or unequal sample sizes. However, changes since the last assessment have been dramatic on an individual reef basis and only limited areas of large resource availability were identified.

The current estimate falls well below the previous ten years' average for both seed and sack oysters (Figure 1.2). However, it is important to note the range of inter-annual variability in this average. There have been several years of heavy localized harvest, high recent mortalities, strong tropical events such as Hurricane Katrina in 2005, the *Deepwater Horizon* oil spill, related spill response activities, and continual limits to recruitment that appear to have severely limited abundances.

Spat Production

Live spat were not present in all samples containing a suitable substrate. Means ranged from 0 to 208.8 individuals per m^2 with the maximum value occurring at the Shell Point cultch plant. Spat densities were extremely low to non-occurring across remaining areas with the second-highest spat density at only 1.6 per m^2 at the Cabbage Reef location. Based on previous years' data, the square meter samples may have occurred between seasonal spawning events in some areas. Of course the number of spat in a given sample is also necessarily related to the amount of substrate collected. However, this continues an observed lack of spat set over several of the reef areas during the spring spawning events. This could be attributed to several different things or a combination of stressors discussed below.

Fouling Organisms

The hooked mussel, *Ischadium recurvum*, was present at seven of the 16 sample stations. The highest density of mussels was 222.4 individuals / m^2 at the Petit Island station. Higher mussel densities were generally restricted to the lower salinity areas in Lake Borgne and western Mississippi Sound. Higher mussel densities were noted pre-stock assessment but dramatic increases in salinity seem to have lowered densities on reefs in eastern Mississippi Sound. Additionally, a sponge-like covering has been present on much of the live oysters and exposed shell in the western and central assessment area. This covering can be quite thick and widespread on the shell. Although still under investigation at time of writing, widespread covering on shell may limit attachment points for oyster larvae.

Oyster Predators

The southern oyster drill, *Stramonita haemastoma*, was not collected at any of the sample stations. The lack of this predator is probably due to extremely cold winter temperatures, and greatly reduced salinities; such conditions which scientific literature show can limit the drill's abundance and distribution. Furthermore, hypoxic conditions in the Study Area may have had direct effects on the oyster drill population as well as the indirect effect of removing the oyster resource within the usually high salinity areas. However, subsequent to stock assessment sampling, oyster drill egg cases were noted on outer, high-salinity reefs in the area. No stone crabs, *Menippe adinia*, or blue crabs, *Callinectes spp*, were collected in dive samples. Other Xanthid crabs were noted in the majority of the samples containing shell.

Mortality

Mortality estimates were highly variable between size classes and stations (Table 1.2) during this sampling event. Spat mortalities ranged from 0 to 100%. Highest spat mortalities were located in Mississippi Sound stations. Seed mortalities ranged from 0 to 100% and were highest in Mississippi Sound and Morgan Harbor. There was no sack mortality noted in stock assessment sampling. Although mortality estimates in many cases were limited to small sample sizes many of these samples were taken after apparently large mortality events that have either subsided or have severely depleted abundances (see Cumulative Impacts and Mortalities section below).

Tropical and Climatic Events

There were no tropical systems affecting the northern Gulf of Mexico since the last stock assessment. However, record rainfall throughout the Mississippi River Basin triggered the opening of the Bonnet Carre' Spillway, diverting water from the Mississippi River to Lake Pontchartrain and adjacent coastal waters. The structure began to open on May 9 and was fully closed on June 20, 2011. Maximum discharges reached 316,000 cubic feet per second (cfs) with an average event discharge of 208,000 cfs. Additionally, the Pearl River system input a relatively large volume of fresh water into western Mississippi Sound in March 2011.

Table 1.1. Mean densities of oysters collected at each station. [1] – station temporarily suspended. Values in parenthesis are percent changes from the 2010 assessment. N/A indicates no live animals in 2011.

Station	Station Number	Reef Group Acreage	Seed Oysters per m2	Sack Oysters per m2	Number of seed oysters (bbls)	Number of sack oysters (bbls)
Grassy Is.	2		0.4	0		
Halfmoon Is.	3	6,850	0.2	0	9.626 (-80%)	3,850 (-92%)
Petit Is.	4		0	0.2		
Grand Banks	23		0.4	0		
Three-mile Bay	5	3,059	0.8	0	12,035	6,877
West Karako	20		0.6	0.4	(N/A)	(0%)
Grand Pass	6		0.0	0		
Cabbage Reef.	7	1,802	0.2	0	1,350 (-51%)	0 (N/A)
Turkey Bayou	11		0.2	0		
Martin Is.	9		0	0	0	0
Holmes Is.	10	4,156	0	0	(N/A)	(N/A)
Shell Point	18	47	26.4	3.2	7,004 (-82%)	1698 (+400%)
Johnson Bayou	17	200	3.2	0.6	3,597 (+1600%)	1,349 (+150%)
Millennium Reef	12	70	0.2	0	79 (-97%)	0 (-100%)
Drum Bay	15	1,796	0	0	0 (-100%)	0 (-100%)
Morgan Harbor	16	2,954	0	0.4	0 (-100%)	13,283 (-33%)
Hospital Wall[1]	1	376				
2011 Total					**33,691 (-72%)**	**27,057 (-72%)**

Both of these events depressed salinities on the reef systems. The salinities of reefs within Mississippi Sound were impacted the most as they are adjacent to areas of freshwater input. Reefs located in western Mississippi Sound experienced salinities less than 5 parts per thousand (ppt) for several weeks (Figure 1.3).

2010/2011 Public Oyster Season

Given the reduced availability of the resource, the Public Seed Grounds east of the River were not opened for the regular 2010/2011 season.

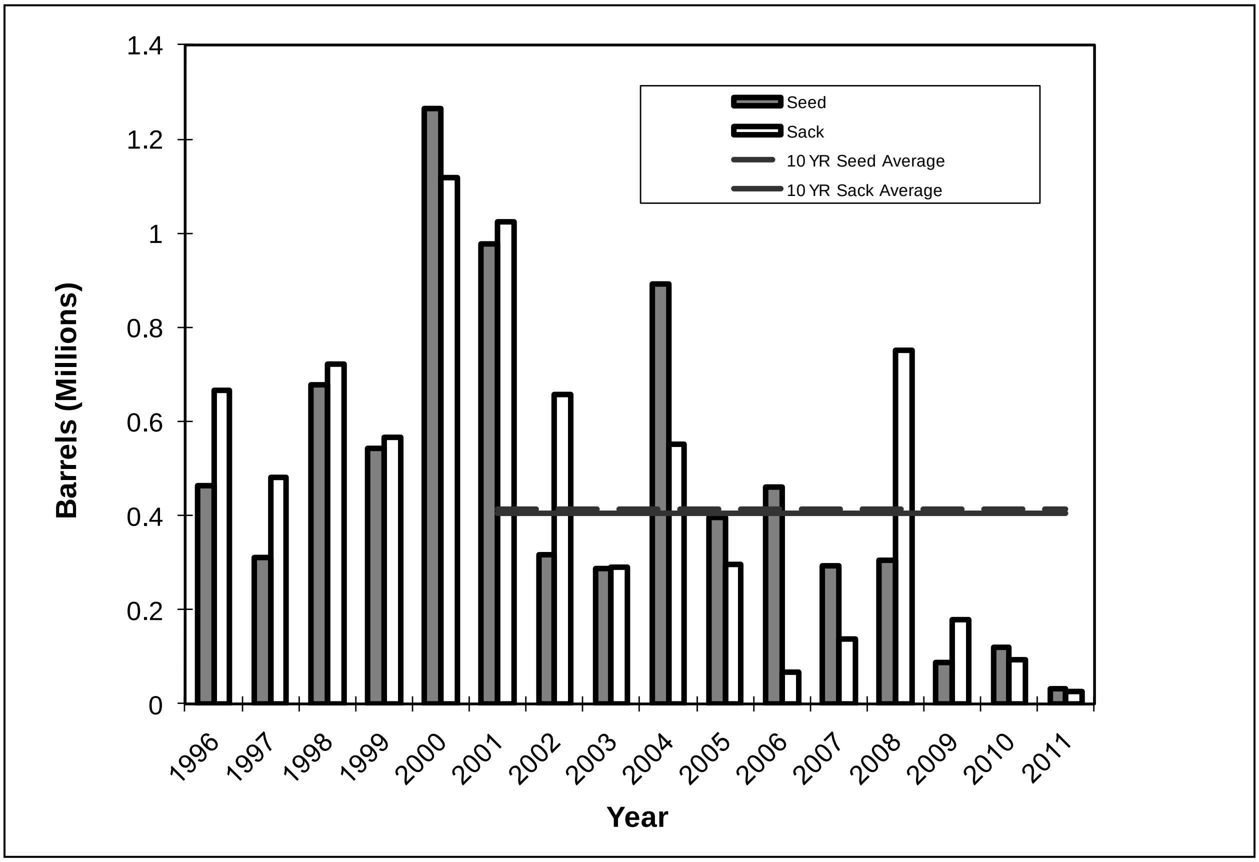


Figure 1.2. Current and historical Stock Assessment (seed and sack oysters) values. Horizontal lines represent the previous ten-years' seed and sack average.

However, in anticipation of impacts from the Bonnet Carre' Spillway, the Louisiana Wildlife and Fisheries Commission (LWFC) chose to open reefs within Louisiana Department of Health and Hospitals (LDHH) Harvest Areas 1, 2, and a portion of 3 to allow the relocation of the resource to leases in protected, higher salinity areas. This included areas that were currently approved for harvest as well as permitted relays from Harvest Area 1 which had been closed by LDHH. The special season ran from May 14 to May 31, 2011. Based on information obtained by LDWF and the LDHH, it was estimated that about 20,395 sacks were relocated to private leases during the season. The majority of harvest was from areas in LDHH Harvest Area 1, recent cultch plants, and the Grand Banks area.

Cumulative Impacts and Mortalities

This section will focus on greater detail concerning environmental conditions observed, as well as direct impacts that have occurred since the previous stock assessment in 2010 or continual impacts to the population. It is also important to note that many of the topics listed below are correlated with one another, i.e. freshwater inputs-salinity stratification-hypoxia.

Deepwater Horizon Oil Spill and Related Response Actions

The *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts of oil and response actions on Louisiana's near shore environment, including oysters and oyster habitat, is ongoing.

Hypoxia

The definition of hypoxia varies as it is based on the percent saturation of water by oxygen. This varies with temperature and amount of other solutes. For most environmental assessments in this area hypoxia can be viewed as concentrations of dissolved oxygen below 3 milligrams per liter (mg/L)

As oysters are a sessile species, reef systems can often be impacted by hypoxia in an estuarine setting. Within the Pontchartrain Basin estuary the most common driver of hypoxia over reef systems is the stratification of the water column due to density differences in water masses. These density differences are oftentimes driven by salinity and temperature. Basically, warmer, fresher water overrides denser salt water and does not allow the diffusion of oxygen throughout the water column.

Table 1.2. Mean oyster mortality (recent) estimates from each square-meter sample station. N/A = no live or dead oysters were collected for mortality estimates.

Station	Spat Mortality (%)	Seed Mortality (%)	Sack Mortality (%)
Grassy Island	N/A	50.0	N/A
Millennium Reef	N/A	0	N/A
Johnson Bayou	100	40.7	0
Petit Island	100	100	0
Half Moon Island	N/A	0	N/A
Three-Mile Bay	20.0	0	0
Turkey Bayou	0.0	0	N/A
Cabbage Reef	20.0	0	N/A
Grand Pass	0	N/A	N/A
Shell Point	14.0	0.1	0
Drum Bay	50.0	N/A	N/A
Morgan Harbor	0	100	0
Martin Island	N/A	N/A	N/A
Holmes Island	N/A	N/A	N/A
Grand Banks	100	0	N/A
West Karako	0	0	0

This is common in areas that have experienced high freshwater inputs, especially after the return of higher salinity waters once freshwater inputs subside. In other cases, in relatively confined areas, increases in biological oxygen demand can also lead to hypoxia, although localized. Some instance of hypoxia is "usual" in most areas, but prolonged exposure can result in reduced growth, decreased disease resistance, or direct mortality.

At the time of the 2010 assessment several reef areas were experiencing hypoxic to anoxic conditions. For example Johnson Bayou, in July of 2010, had a surface salinity of 9.3 ppt and a bottom salinity of 20.3 ppt. This resulted in dissolved oxygen (DO) surface and bottom values of 8.1 and 0.9 milligrams per liter (mg/L), respectively. An adjacent station, Turkey Bayou, registered a bottom DO

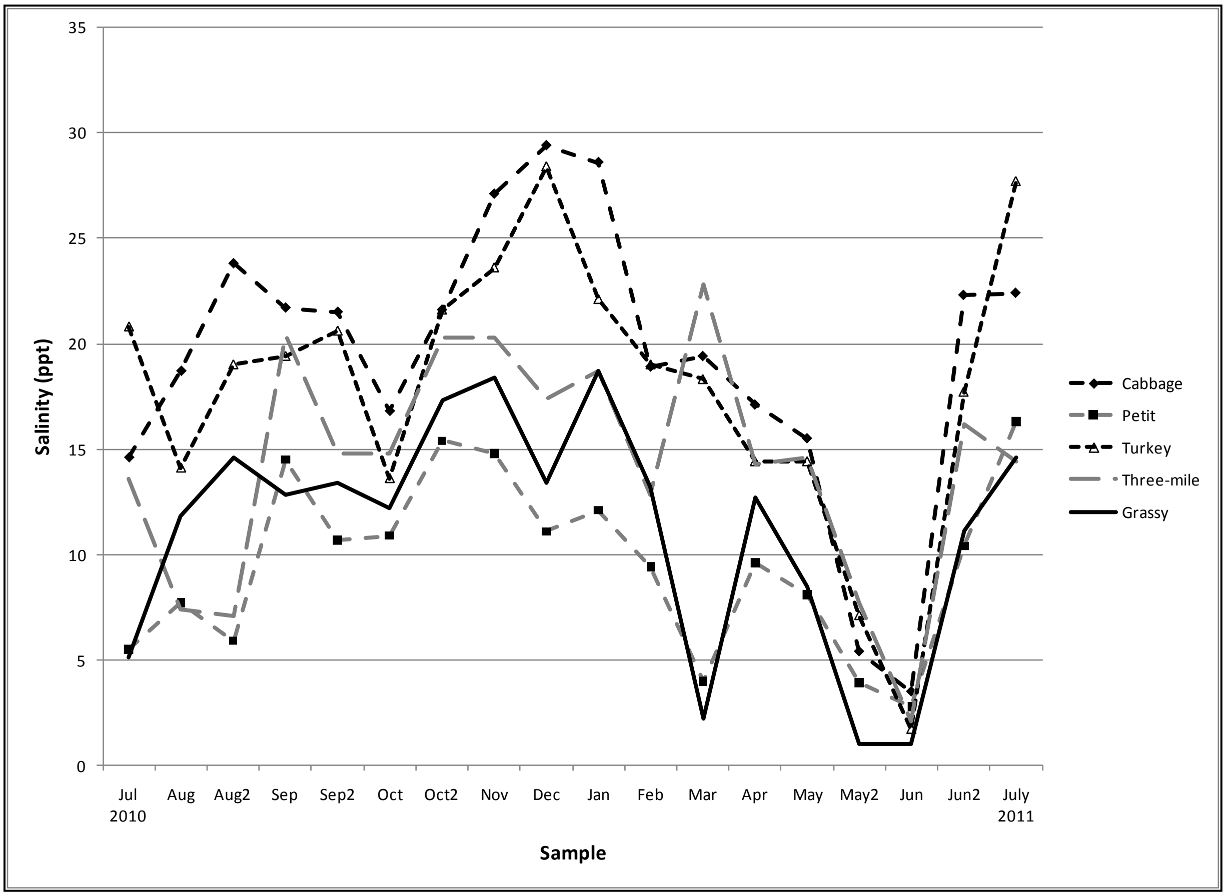


Figure 1.3. Salinities for the northern Mississippi Sound public seed grounds since 2010 Assessment. Data presented are from discrete measurements taken on each reef once per month or twice when denoted with a second monthly reading.

value of 0.4 mg/L. During that assessment, few live oysters were found at the Johnson Bayou which had been a very productive area since its creation in 2007. At the Turkey Bayou station recent seed mortality was estimated at 92% with sack mortality at 100%. It is apparent that hypoxia is certainly a contributing factor to the overall mortality within a reef system.

Hypoxic conditions were also noted prior to the 2011 assessment. This condition was brought about by interaction of freshwater inputs and the higher salinity waters of Chandeleur Sound. Lowered DO concentrations and hypoxia became widespread throughout the assessment area starting in June 2011 and had become persistent in some areas. At the time of the 2011 assessment all of the nine stations in Mississippi Sound had bottom DO values at or below 4 mg/L. All but one of those had values at or below 3 mg/L.

Freshets

As mentioned previously, the Bonnet Carre Spillway structure was opened in May of 2011. Although not instantaneous, water from this structure makes its way through Lake Pontchartrain and eventually the surrounding waters of Lake Borgne and the Mississippi Sound. The reefs within western Mississippi Sound were impacted first and saw the longest duration of depressed salinities. For example Grassy Island, in extreme western Mississippi Sound, had bottom salinities of 1 ppt on May 24th and June 6th of 2011. Although these values are discrete measurements these values were also seen in non-related observations as well as data derived from continuous salinity recorders within the area. Given the above, it is likely that these bottom salinities, with some variability, were below 5.0 ppt for an extended period. This salinity suppression extended to eastern Mississippi Sound where a bottom salinity reading of 3.5 ppt was recorded at Cabbage Reef. Lowered salinities persisted over the Mississippi Sound and adjacent reefs until late June when the structure was closed and changing weather patterns allowed for higher-salinity waters to return from the Gulf of Mexico.

While freshets often provide benefits to the reef system, either by reducing disease or predation, or enhancing cultch opportunities, there are often other cumulative impacts that may affect recovery from any one event. The impact/recovery are also modified by not only the magnitude of a freshet, but perhaps also by the duration and timing.

Sedimentation/Subsidence

During periods of high freshwater input, sedimentation over reefs can be a problem. This sedimentation can affect the reef either through direct mortality (burial) or through reduced growth and reproduction (both production and clean places for larval attachment). During the 2011 assessment, divers noted on many reefs, especially in the Mississippi Sound area, that some of the cultch had a covering of silt and still other areas were buried. Both of these conditions limit the amount of suitable substrate available for larval settlement.

Subsidence of the reefs is usually balanced by reef accretion or growth. If no appreciable shell is added over a period of time, the reefs, especially those in less than optimal environments, will subside to the point of shell burial. The lowering of the reef profile also subjects associated organisms to more frequent hypoxia events as well as changing the local water flow and sedimentation processes.

Cultch Condition

Any successful spat set is dependent on clean, stable cultch for larval attachment. The condition of the cultch and live oyster shell within the Pontchartrain Basin appears to be currently poor. As noted above, many areas are buried or covered with a thin layer of silt. Much of the shell within the areas east of the River are also covered with an unidentified algal/sponge growth. Although still under investigation, this covering may serve to limit suitable area for attachment of oyster larvae. In other areas, the addition of shell to a reef has become so infrequent that the cultch on hand is being transformed into small “hash” particles that may not provide optimal substrate for larval attachment.

Harvest

As stated previously, a special season was held in advance of expected Bonnet Carre’ Spillway impacts. It was estimated that at least 20,000 sacks were relocated from endangered areas during the season. Although the season was for bedding-only, all fishermen reported harvested amounts in sacks. Also, it is not known what percentage of the harvest was seed-, sack-sized, or shell. Therefore, no estimate of total number of individual oysters removed can be made.

Intra-assessment mortalities

Given all of the above, we can examine mortality estimates generated within the assessment period. This year a subset of stations was sampled quantitatively in May to determine a baseline prior to the arrival of freshwater via the Bonnet Carre’ Spillway opening. Three of the stations contained sufficient data to compare to the July assessments. All three of the stations (Grand Banks, Johnson Bayou, Millenium Reef) showed decreases in availability from May to July. When numbers are pooled there was an 84% reduction in seed oysters and an 88% reduction in market-size oysters between the sampling events. Changes in abundances from May to July, and changes between full assessments, indicate that a significant mortality event has taken place. This is also corroborated by recent mortality estimates obtained in supplemental dredge tows on three Mississippi Sound reefs made in early July. Although the estimates were based on small numbers of individuals, mortality estimates ranged from 30.8 to 85.2% for seed oysters and 10 to 64.3% for market-size oysters.

The values above help to explain changes in availability where single point mortality estimates do not. Although background natural mortality may certainly shape a population, there has apparently been other, higher magnitude, mortalities since the last stock assessment. These seem to have come primarily immediately after the 2010 assessment and one to two months before the 2011 assessment.

South Pontchartrain Basin (CSA 1S) – Oyster Stock Assessment

Introduction

The Public Oyster Seed Grounds (POSG) located in the South Pontchartrain Basin (Basin) include areas south of the Mississippi River Gulf Outlet (MRGO) to the Mississippi River, and from the eastern extent of private leases to the Breton National Wildlife Refuge. This area encompasses approximately 300,000 of the 880,597 total acres of POSG east of the Mississippi River and includes areas designated "sack harvest only" in Lakes Fortuna and Machias, and Bay Long, as well as the Bay Gardene Public Oyster Seed Reservation. Historically this area has provided seed- and market-sized oysters for oyster fishermen both east and west of the Mississippi River. Hydrology in the area is affected at high Mississippi River stages by discharge through gaps in the levee south of Pointe a la Hache , discharge from the Caernarvon and Bayou Lamoque freshwater diversion structures, the siphon at White's Ditch, and the main-stem river distributaries in the south.

An active cultch planting program has been in effect in the area for a long period of time with two recent cultch plants in 2007 and 2009. Numerous cultch plants have been constructed throughout the area since 1917 in places such as Bay Gardene, Bay Crabe, Black Bay, and California Bay. Several more cultch plants are planned in the near future within this part of the Basin.

Currently, these areas are managed in an effort to balance the economic opportunity of the fishery with the long term biological sustainability of the resource. This management is contingent upon obtaining and utilizing the best fishery dependent and independent data available. This includes monitoring the harvest and resource availability throughout the fishing season and performing yearly stock assessments. The information these data provide allow resource managers to implement management changes to both effectively utilize the current resource as well as protect long term viability. This report will fulfill one of those data needs by providing estimates of the current stock size of the oyster resource within this portion of the Basin.

Methods

Samples were taken between July 19 and August 1, 2011 using a one square-meter frame randomly placed on the bottom. Divers removed all enclosed live and dead oysters, as well as shell, by hand. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. A total of 31 stations were visited with 5 square-meter replicates taken at each station except for the 2009 cultch plant. At the cultch plant, five $0.25m^2$ replicates were made. The average of the replicates was then pooled within reef systems. This average density per reef, or reef system, was then multiplied by the total area (reef acreage). The resulting number was adjusted into a barrel unit of measure where one barrel equals 720 seed-sized oysters or 360 market-sized oysters. Seed oysters are those measuring between 25 and 74 mm with market oysters being greater than 74 mm. Spat oysters are those less than 25 mm.

Results and Discussion

Seed and Sack Stock

The current stock size is estimated at 16,148 barrels (bbls) of seed oysters and 68,725 bbls of market sized oysters for a total of 84,873 bbls of overall stock. These numbers include all of the currently assessed reefs and the 2009 Black Bay cultch plant (Figure 2.1). Overall abundance is down 42% from last year, down 93% from the 10 year average (2001 - 2010), and down 95% from the long term average (1982 – 2010). Seed oyster stock is down 84.8 % from last year, and is the lowest estimated abundance since 1982. Sack oyster stock is up 72.9% from 2010 but is 87% below the past ten years' average, and 89% less than the long-term average (1982 – 2010) (Figure 2.2).

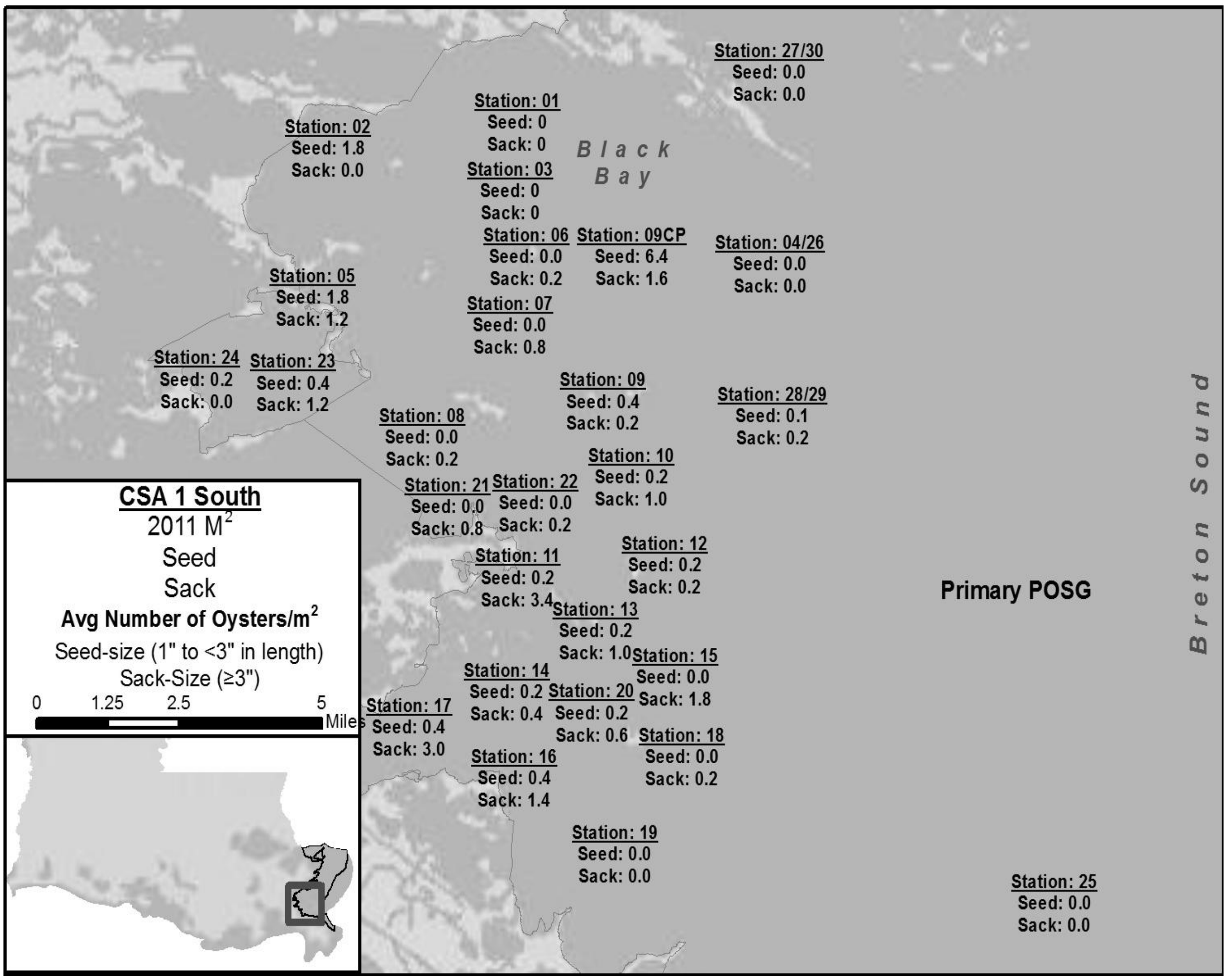


Figure 2.1 Map Showing assessment stations within the South Pontchartrain Basin. Numbers below stations are average numbers of seed and sack oysters per m^2.

Oyster density and abundance was not evenly distributed among areas (Table 2.1) with the highest density and abundance of seed oysters found on the 2009 Cultch Plant. The highest density of sack-sized oysters was located in Elephant Pass with the highest total abundance found on the Bay Long reef system.

Seed-sized oyster stock decreased from 2010 levels and seed oysters were not found at 11 stations. The anticipated (predicted) increase in seed stocks after successive high freshwater inputs has not been realized (see Cumulative Impacts for further discussion). Approximately 8% of seed oysters (not available for bedding) are located in areas historically designated as sacking only (Lake Fortuna and Bay Long) with all of that resource located in Bay Long.

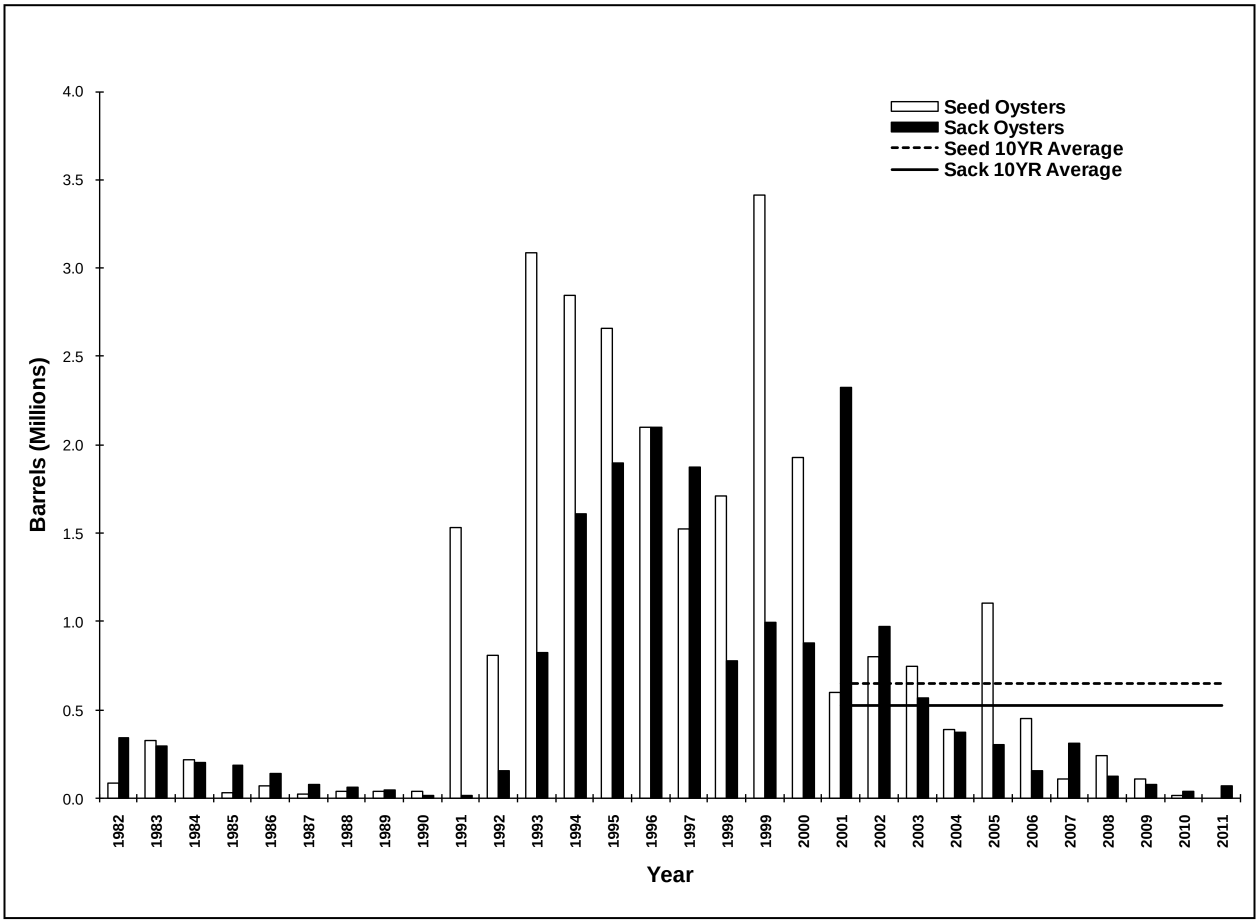


Figure 2.2. Current and historical Stock Assessment values. Horizontal lines represent the previous ten-years' seed and sack average.

Spat Production

Live spat were observed at only 5 stations. Densities ranged from 0 to 0.8/m^2. When extrapolated, the largest single sample per station would have been 4 individuals. Although these assessment events may occur outside of the peak spawning period, it is evident that there has been little to no spring or summer spatcatch on these reefs. This marks a continuation of poor to no spat catches within this area. This may be attributed to several causes discussed below.

Mortality

Mortality estimates were highly variable between size classes and stations (Table 2.2). Spat mortalities ranged from 33.3 to 100%. However, as stated above live spat were only sampled at 5 stations with dead spat noted at 13. Seed mortalities ranged from 0.0 to 100% with an average mortality of about 40%. There was no sack-sized mortality noted in the assessment samples, but sample sizes were extremely low and it was apparent that previous mortality events had already taken place on many of the stations.

Table 2.1. Mean density and abundance of live oysters per reef system. Percent changes are from 2010 Stock Assessment.

Station		Approx. Reef Acres	Seed Oysters per m^2	Sack Oysters per m^2	Number of Seed Oysters (bbls)	Number of Sack Oysters (bbls)
1	Snake	506	0	0	0	0
2	Jessie	59	1.8	0	597	0
3	North Lonesome	896	0	0	0	0
5	Bayou Lost	118	1.8	1.2	1194	1592
6	Lonesome	473	0	0.2	0	1063
-	2009 Shell plant	243	6.4	1.6	8742	4371
7	Black Bay	301	0	0.8	0	2707
8	West Bay Crabe	501	0	0.2	0	1126
9	Stone	461	0.4	0.2	1036	1036
10	South Black Bay	145	0.2	1.0	163	1630
11	Elephant	339	0.2	3.4	381	12957
12	Curfew	425	0.2	0.2	478	956
13	North California	109	0.2	1.0	123	1225
14	California	7	0.2	0.4	8	31
16	Sunrise	174	0.4	1.4	391	2738
17	Bay Long	572	0.4	3.0	1286	19291
19	Mangrove	937	0	0	0	0
20	West Pelican	293	0.2	0.6	329	1976
21	Bay Crabe	659	0.0	0.8	0	5927
22	East Bay Crabe	122	0.0	0.2	0	274
23	East Bay Gardene	28	0.4	1.2	63	378
24	Bay Gardene	69	0.2	0	78	0
4,26	North Black Bay	315	0	0	0	0
15	Telegraph	127	0	1.8	0	2570
18	East Pelican	782	0	0.2	0	1758
25	Battledore	1419	0	0	0	0
27,30	Lake Fortuna	4288	0	0	0	0
28,29	Wreck	2276	0.1	0.2	1279	5117
2011 Totals					**16,148**	**68,725**
Percent Change					**-84.8%**	**+72.9%**

Deepwater Horizon Oil Spill and Related Response Actions

The *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline, including oyster habitat. In direct response to the spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessment continues on the direct and indirect impacts of oil and response actions to Louisiana's near shore environment, including to oysters and oyster habitat.

Fouling Organisms

Hooked mussels (*Ischadium recurvum*) are a sessile bivalve that is oftentimes associated with oyster reefs and competes with oysters for food and settlement surfaces. During the assessment samples hooked mussels were present at each station and ranged in density from 3.2 to 422.5 individuals / m^2. Overall hooked mussel density has increased over the previous assessment with the largest increases in density coming from reefs in Black Bay and Bay Gardene. Although some decreases were noted they were of a small magnitude.

Additionally, a sponge-like covering has been present on much of the live oysters and exposed shell in within the assessment area. This covering can be quite thick and widespread on the shell and may limit the attachment of oyster larvae.

Oyster Predators/Disease

The southern oyster drill (*Stramonita haemastoma*) is a predatory marine gastropod known to prey on oysters and other sessile animals using a small tooth-like scraping organ called a radula to bore a hole through the oyster shell. Snails were found at only one station (Wreck) with no egg cases found in any of the samples. The recent extended periods of low salinity may have limited snail abundance in the area. No stone crabs (*Mennipe adinia*) or blue crabs (*Callinectes sapidus*) were observed in the samples.

Perkinsus marinus (= dermo), a protozoan parasite that infects oyster tissue, is known to cause extensive oyster mortalities especially under high salinity and high water temperature conditions. Dermo samples were attempted at 7 stations throughout the area. Of those seven stations only five contained sufficient sack-sized oysters and only one contained enough oysters for a seed-size analysis (see Dermo section in this document for further information).

Tropical and Climactic Events

There were no substantial tropical systems impacting the northern Gulf of Mexico during the assessment period. However, record rainfall along the Mississippi River drainage led to severe and prolonged flood conditions along most of its reach, including Louisiana. River levels prompted the opening of both the Bonnet Carre Spillway and the Morganza Floodway to protect the cities of New Orleans and Baton Rouge.

The main input of freshwater to the Basin during this flood event was from main-stem distributaries and breaches/spillways, such as the Pointe a la Hache relief outlet located below the town of Pointe a la Hache, Louisiana. This outlet comprises several river miles of low levees that are regularly overtopped with high Mississippi River stages. Salinities throughout the entire system were depressed through the spring and early summer and, in most areas, showed a steady decline from late winter until conditions changed in late June and early July. (Figure 2.3).

On several of the reefs salinities remained under 5 parts per thousand (ppt) for 2 to 3 weeks. Most of the areas adjacent to the River remained under 5 ppt for much longer. By the time of assessment, all station bottom salinities had risen to greater than 5 ppt. Worth noting, however, was a 2.7 ppt surface salinity at Battledore reef which shows the continual residence and movement of the freshwater within systems near the River.

Table 2.2. Size-specific mortalities during 2011 Assessment. N/A – no live animals collected at station

Station	Spat Mortality (%)	Seed Mortality (%)	Sack Mortality (%)
Snake	N/A	N/A	N/A
Jessie	100	18.2	N/A
N. Lonesome	N/A	100	N/A
Bayou Lost	36.4	35.7	0
Lonesome	N/A	N/A	0
09 Shell plant	N/A	20	0
Black Bay	100	N/A	0
W. Bay Crabe	N/A	N/A	0
Stone	100	33.3	0
S. Black Bay	N/A	0	0
Elephant	100	83.3	0
Curfew	33.3	0	0
N. California	N/A	66.6	0
California	N/A	0	0
Sunrise	N/A	0	0
Bay Long	N/A	0	0
Mangrove	100	100	N/A
W. Pelican	100	50	0
Bay Crabe	N/A	N/A	0
E. Bay Crabe	N/A	N/A	0
E. Gardene	N/A	0	0
Bay Gardene	55.5	66.6	N/A
N. Black Bay	100	N/A	N/A
Telegraph	N/A	N/A	0
E. Pelican	N/A	100	0
Battledore	50	N/A	N/A
L Fortuna	50	N/A	N/A
Wreck	100	50	0
AVERAGE	78.9	40.2	0

2010/2011 SEASON SUMMARY

Given the declining availability of the resource and potential impacts from the Deepwater Horizon Oil Spill, the Public Seed Grounds east of the River were not opened for the regular 2010/2011 season. Although historical records are incomplete, this may be the first time that the entire public oyster seed ground was closed to harvest for the entire season.

Cumulative Impacts and Mortalities

This section will focus on greater detail concerning some environmental conditions observed as well as direct impacts that have occurred since the 2010assessment or continue to impact the oyster resource. It is also important to note that many of the topics listed below are correlated with one another, i.e. freshwater inputs-salinity stratification-hypoxia.

Hypoxia

The definition of hypoxia varies as it is based on the percent saturation of water by oxygen. This varies with temperature and amount of other solutes. For most environmental assessments in this area hypoxia can be viewed as concentrations of dissolved oxygen below 3 milligrams per liter (mg/L).

As oysters are a sessile species, reef systems can often be impacted by hypoxia in an estuarine setting. Within the Pontchartrain Basin estuary the most common driver of hypoxia over reef systems is the stratification of the water column due to differing density water masses in turn driven by salinity and temperature. Basically, warmer, fresher water overrides denser salt water and does not allow the diffusion of oxygen throughout the water column. This is common in areas that have experienced high freshwater inputs, especially after the high flows have stopped and allow higher saline bottom waters to return. This can also be modified by amount of sunlight and physical mixing (wind/current). In other cases, in relatively confined areas, increases in biological oxygen demand can also lead to hypoxia, although localized.

Although some instance of hypoxia is "usual" in most areas, prolonged exposure can result in reduced growth, decreased disease resistance, or direct mortality. During the assessment period nine of the stations experienced DO values less than 3 mg/L. At the time of writing many areas within the Pontchartrain Basin were still experiencing hypoxia with several areas showing levels approaching anoxia (extremely low dissolved oxygen).

Freshets

As mentioned previously, the Mississippi River reached, and remained at, flood stage for an extended period in early 2011. Higher than average River discharge also occurred late in 2010. Salinities were suppressed over many of the reefs below the "critical" concentration of 5 ppt. These lowered salinities also coincided with warm water temperatures. This is the fourth consecutive year of abnormally high spring inputs or late season increases in Mississippi River discharge. While freshets often provide benefits to the reef system, either by reducing disease or predation, or enhancing cultch opportunities, we must also realize that other variables are also operating at the same time. The impact/recovery may also be modified by not only the magnitude of a freshet, but also the duration and timing. Specifically this area has experienced two such events over the assessment period occurring during, or very near, peak spring and fall spawning times.

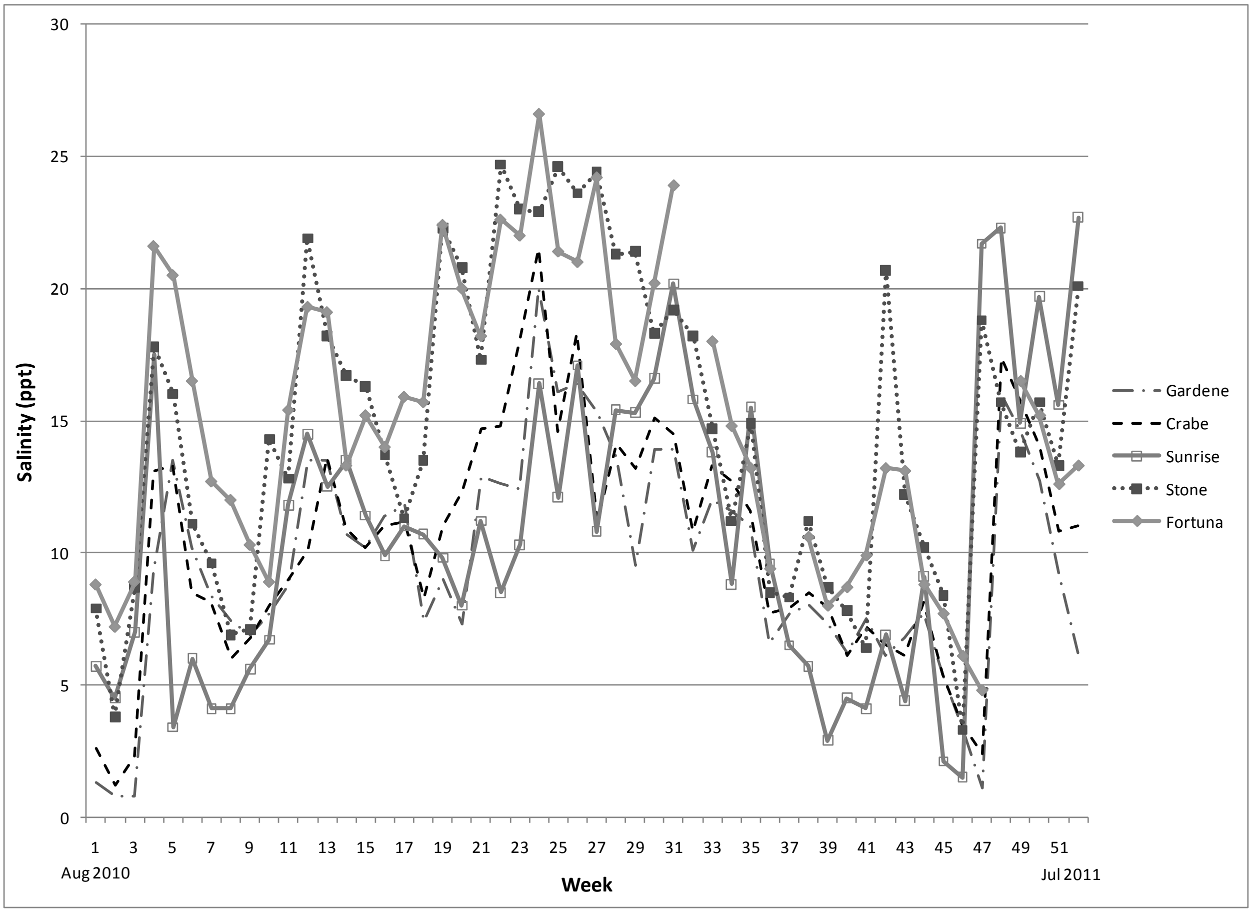


Figure 2.3. Weekly bottom salinities from August 2010 through July 2011 over 5 selected reef areas.

Sedimentation/Subsidence

During periods of high freshwater input sedimentation over reefs can be a problem. This sedimentation can affect the reef either through direct mortality (burial) or through reduced growth and reproduction (both production and clean places for larval attachment). During the 2011 assessment, divers noted on several reefs that some of the cultch had a covering of silt and still others had buried cultch. Both of these conditions limit the amount of suitable substrate available for larval settlement.

Subsidence of the reefs is usually balanced by reef accretion or growth. If no appreciable shell is added over a period of time, the reefs, especially those in less than optimal environments, will subside to the point of shell burial. The lowering of the reef profile also subjects associated organisms to more frequent hypoxia events as well as changing the local water flow and sedimentation processes.

Cultch Condition

Any successful spat set is dependent on clean, stable cultch for larval attachment. As stated in previous sections the condition of the cultch within the Basin appears to be currently poor. Many areas are buried or covered with a thin layer of silt. Much of the shell within areas east of the river is also covered with an algal/sponge growth. Although still under investigation at time of writing, widespread covering of a substance on shell may limit attachment points for oyster larvae. In other areas, the addition of shell to a reef has become so infrequent that the cultch on hand is being transformed into small "hash" particles that may not provide optimal substrate for larval attachment.

Harvest

Although no harvest was authorized on the public reefs within the assessment area, harvest over the previous years, especially seed harvest, should be included in cumulative impacts.

Intra-assessment mortalities

Given all of the above we can also examine mortality estimates generated within the assessment period to examine effects on abundance. This assessment period in particular had a unique study conducted one month after the completion of the 2010 assessment. The study was initiated to examine mortalities on the public and private oyster bottoms in the Breton and Barataria estuaries. When looking at the public grounds in the Breton Sound estuary, recent mortalities of seed and sack were estimated at 62.4 and 39.3%, respectively. More important to note was that the areas further "inshore" suffered the highest mortalities. These are the areas with the greatest production on the public grounds. For example, two stations in Bay Gardene both had combined (seed+sack) mortalities of 100%. Bay Crabe was listed at 50% and Snake Island at 44%. These three systems were responsible for 22% of the overall availability in the 2010 assessment. This fell to 9% in the current assessment. More dramatically, in the 2010 assessment these three reef systems had an estimated 26,247 barrels of seed-sized oysters. The 2011 assessment estimates 141 barrels, a decrease of 99.5%. In comparison, the 2011 assessment shows somewhat higher mortality estimates on reefs in "offshore" areas when compared to the 2010 mortality study. The results reflect the cumulative effects of factors within and prior to the assessment period acting on a basin-wide level as well as the dynamic nature of these factors.

Coastal Study Area (CSA) 3 – Oyster Stock Assessment

Introduction

For the purpose of oyster management, Coastal Study Area (CSA) 3 consists of three public oyster areas distributed generally in a north-south direction within the Barataria Bay estuary: 1) Little Lake Public Oyster Seed Grounds, 2) Hackberry Bay Public Oyster Seed Reservation, and 3) Barataria Bay Public Oyster Seed Grounds. Hackberry Bay is the oldest of the three as it was designated by the Louisiana Legislature as a public oyster seed reservation in 1944. Barataria Bay was designated by the Louisiana Wildlife and Fisheries Commission (LWFC) as a public oyster seed ground in 2000, and Little Lake was designated by the LWFC in 2007. Coastal Study Area 3 (CSA 3) has historically monitored three sampling sites for annual oyster stock assessment, all in Hackberry Bay. Sampling has expanded in recent years, however, with the addition of the Barataria Bay Public Oyster Seed Ground, and the addition of newly constructed oyster reefs in Hackberry Bay.

Hackberry Bay (Jefferson/Lafourche Parishes) is an approximately 4402-acre mesohaline lake with a mostly soft silt and clay bottom, of which approximately only 14.7 acres is naturally occurring reef material. The three historical sampling sites within Hackberry Bay are the upper, middle, and lower Hackberry sampling sites. The middle Hackberry site is the only site located over historical existing reef while the upper and lower sites are over former cultch plants placed on top of historical reefs. The upper Hackberry sampling site was the result of a 1994 cultch plant using federal disaster funds from Hurricane Andrew in 1992. The upper site had also been the location of cultch plants in 1943 (140 acres), 1945 (70 acres), 1946 (92 acres) and 1981 (67 acres). The 1994 cultch site was comprised of six different sections of substrate for a total of 145 acres. The substrates were crushed concrete, shucked shell, reef shell, mixed shell, Kentucky limestone and Bahamian limestone. The lower Hackberry sampling site is on a reef that was part of a 450 acre 1973 cultch plant. Since very little natural reef exists in the Hackberry Bay Public Oyster Seed Reservation, production is highly dependent upon and reflective of when and where cultch plants are placed in the bay. It is unknown how much, if any, cultch material from the 1994 and earlier cultch plants remains exposed above the surface of the mud. Therefore, the acreage of these cultch plants is not factored into the annual oyster stock assessment.

In response to impacts from Hurricane Lilly in 2002, two cultch plants were placed in Hackberry Bay in 2004. The northern Hackberry Bay cultch plant, 10 acres, was planted near the old 1994 cultch plant on May 10, 2004 using approximately 2,322 cubic yards of #57 limestone. The southern Hackberry Bay cultch plant, 25 acres, was planted between May 10 and 12, 2004 using approximately 4,005 cubic yards of #57 limestone.

In 2008, a new cultch plant was placed in the northeastern portion of Hackberry Bay using federal funds dedicated to the impacts of Hurricanes Katrina and Rita. The 2008 cultch plant is approximately 50 acres in size and was planted between May 20 and 25, 2008 using approximately 75% #57 limestone, 15% crushed concrete, and 10% oyster shell. The total amount of material was approximately 10,171 cubic yards weighing approximately 13,223 tons.

The Barataria Bay Public Oyster Seed Ground was designated as a public oyster ground in response to possible changes in the salinity regime of the estuary stemming from the Davis Pond Freshwater Diversion project. Davis Pond is a large Mississippi River diversion project that aims to reintroduce freshwater and nutrients into the Barataria Bay estuary. As this new coastal restoration project was anticipated to reduce salinities in the estuary, LDWF felt that an additional public oyster seed ground farther down-estuary may be productive during years with high freshwater input. The only known reef in existence on the Barataria Bay Public Oyster Seed Ground is a 40-acre reef constructed in 2004 utilizing Coastal Impact Assistance Program (CIAP) and Oyster Seed Ground Development Account (compensation from oil and gas impacts) funding. The reef is comprised of approximately 7,536 cubic yards of crushed concrete. The Barataria Bay cultch plant was placed onsite from May 6 to 8, 2004 and is located in the northeast section of the Barataria Bay Public Oyster Seed Ground. It is vulnerable to predators such as oyster drills and other stressors (i.e., Dermo) associated with higher salinities. Consistent production cannot be expected until salinity regimes in the basin change due to natural forces or coastal restoration efforts.

On February 1, 2007 the Louisiana Wildlife and Fisheries Commission (LWFC) created the Little Lake Public Oyster Seed Ground (POSG). This area had been utilized in the past as a temporary natural reef area, last in 2004, and was once covered with private oyster leases. These leases all fell within the Davis Pond freshwater diversion impact area and were either purchased or moved by the state and federal government prior to the opening of Davis Pond. Davis Pond has not been consistently utilized to its maximum capacity since it first opened in 2002, and environmental conditions during some years have allowed oysters to continue to exist in Little Lake. Therefore, the LWFC designated this area a public oyster ground so that oysters could be harvested and reefs could be actively managed by LDWF. The location of the Little Lake POSG makes it vulnerable to freshwater input from the northern portion of the basin such as heavy rainfall, freshwater input from the Intracoastal Waterway and outflow from the Davis Pond freshwater diversion. Reduced salinities caused by these sources of freshwater can have a negative impact on oyster survival and availability. However, when higher salinities in the northern portion of the basin exist the Little Lake POSG has allowed the oyster industry access to additional seed and sack oysters in the Barataria Bay Basin. Since very little information on reef acreage exists for Little Lake, LDWF hopes to undertake a water bottom assessment of the area in the future.

Materials and Methods

Samples used in this assessment were collected by CSA 3 staff on July 20 and 21, 2011. All samples were taken using a one square-meter frame placed randomly on the bottom over reef at each sampling location. Using SCUBA, all live and dead oysters, as well as shell, in the upper portion (exposed) of the substrate were removed from the area enclosed in the frame. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. All oysters were measured in 5 millimeter work groups and divided into size groups of spat (0-24mm), seed (25-74mm), and sack oyster (75mm and greater). A total of seven stations were visited (Figure 3.1) with five replicate square meter samples taken at each location. The average of the five samples at each station was used, in combination with reef acreage, to estimate the current oyster availability for CSA 3. The Little Lake POSG was not sampled due to lack of reef acreage information.

Results and Discussion

Seed and Sack Stock

Stock for the Hackberry Bay Public Oyster Seed Reservation (POSR), including the 2004 and 2008 cultch plants, is estimated at 18,341 barrels of seed size oysters and 2,955 barrels of market size oysters for a total of 21,296 barrels of overall stock. Seed were present at all stations. Seed availability is up 265% from 2010, 512% above the past 10 year average, and 29.4 % above the long term average since 1976. Sack oysters were also present at all stations with stock up 144.9% from last year, 82.7% above the past 10 year average, but 63.7 % below the long term average since 1976 (Table 3.1, Figure 3.2). Combined stock increased 242% over 2010, 361.6% over the 10 year average, but 4.6 % below the long term average since 1976. Seed oysters averaged 1.41 inches with approximately 89% in the 1-2 inch size range. Sack oysters averaged 3.53 inches with approximately 88% in the 3-4 inch size range. The increase in seed and sack stock may be related to multiple factors such as salinity, predation levels, disease, exposed cultch, and water temperature. In addition, the Hackberry Bay Public Oyster Seed Reservation was closed to harvest on Nov 4, 2009 and remained closed through the stock assessment sampling in 2011. This twenty month period without harvest could have allowed undisturbed recruitment and growth resulting in an increase in stock. In addition to the harvest closure, LDWF and LSU released approximately 100M larvae on June 2, 2011 at the 2004 North Hackberry Bay Cultch Plant approximately 1.5 months prior to stock assessment sampling. These larvae may have settled and grown to seed size by the time stock assessment sampling occurred. Oyster leaseholders in surrounding bays reported a spatfall event in June 2011, so natural oyster reproduction may have also contributed to the increase in seed oyster abundance. Additionally, small sample sizes often lead to large amounts of variability around an estimate. While statistical comparisons of the 2010 and 2011 estimate (stock size) variability have not been conducted, a thorough statistical analysis may show that the increase is not statistically significant and within the range of error expected from an estimate generated by low sample sizes.

No live spat, seed, or sack oysters were observed in the Barataria Bay POSG (Figure 3.1, Table 3.1). Market-size oyster availability has not been documented on the Barataria Bay POSG since it was created in 2004.

Spat Production

Live spat were present at all stations in Hackberry Bay and ranged from 0 to 248 spat per square meter with an average catch of 47.2. This is well above the long-term average since 1975 (6.6 spat/frame) and second only to 2000's catch of 61.2 spat per square meter. The highest numbers were found at both 2004 Hackberry Bay cultch plants. 79.5% of spat observed were greater than ½ inch (Figure 3.3).

No live spat were observed in the Barataria Bay POSG. Considerable fouling was observed on the exposed cultch and may have contributed to the lack of a successful spat set. Since its creation in May 2004, the only stock assessments with a record of spat were in the assessments of 2005 (8 spat per M^2), 2009 (53.5 spat per M^2), and 2010 (5.2 spat per M^2).

Fouling Organisms

The hooked mussel (*Ischadium recurvum*), is a reef-associated benthic bivalve species that competes with oysters for food and settlement surfaces. Hooked mussels were present at all six sampling locations located in Hackberry Bay with the highest densities at the 2004 North cultch plant (Table 3.2). The average number of hooked mussels observed in the Hackberry Bay POSR was 31.2 per square meter. This represents an increase over last year's average of 19.7 per frame and may be attributable to lower salinities in the basin.

Although no hooked mussels were found in any of the Barataria Bay POSG samples, considerable fouling was observed on the cultch in all five replicate samples taken.

Mortality

Recent spat mortality on the Hackberry Bay POSR ranged from 6.1% to 13.3% with an average of 9.4%. Recent seed oyster mortality ranged from 3.1% to 4.5% averaging 3.3%. No recent mortalities in sack size oysters were observed (Table 3.2).

The Barataria Bay POSG exhibited 100% recent mortalities in both spat and seed oysters. A total of five recently dead spat were observed in the five square meter samples taken in Barataria Bay. Four recently dead seed oysters were observed in the same five samples. No live or recently dead market size oysters were observed.

Additional sources of oyster mortality data available since the 2010 oyster stock assessment include the on-going Nestier tray project and a special Oyster Mortality Study Project.

Due to extended periods of depressed salinities during the spring and summer of 2010, an Oyster Mortality Study was initiated in August 2010. Dredge samples were taken at multiple sites on public grounds and private leases throughout the Barataria basin and oyster mortality was recorded. Mortality on the public grounds was estimated at 45% for seed, 19.4% for sack, and 34.7% combined. Spat mortality was estimated at 49%. Locations in the upper estuary exhibited higher mortality than those in the lower basin with the exception of Bay Jaques (100% mortality) which is located near the mouth of the Mississippi River.

The Nestier tray project places oysters in trays at multiple sites throughout the Barataria basin in January and mortality data is recorded from the trays on a monthly basis. By the end of May 2011, oyster mortality on the Nestier trays placed in Hackberry Bay in January 2011 was 7.7%. One hundred percent mortality was observed at tray sites in Grand Terre Bay, Bay des Ilettes, and Bay Batiste.

Oyster Predators

The Southern oyster drill (*Stramonita haemastoma)* is a predatory marine snail that feeds on oysters and other sessile organisms using a radula (a small tooth-like rasping organ) to bore a hole through the shell. Neither snails nor their associated egg cases were observed from any samples on the Barataria Bay POSG or the Hackberry Bay POSR.

Tropical and Climatic Events

Higher than normal Mississippi River flows occurred in both 2010 and 2011. According to data supplied by the United States Army Corps of Engineers (USACE) website, Mississippi River flow was above the LTA (1961-2010) in January, February, and from May to October 2010. Flow was also above the LTA from March through June 2011 (Figure 3.4). Both the Morganza and Bonnet Carre’ spillways were opened in 2011 to relieve pressures on New Orleans levees.

Output through the Davis Pond freshwater diversion through most of 2010 and 2011 continued to be above the long term average since the structure opened in 2002 (Figure 3.5). According to the United States Geologic Survey (USGS) constant data recorder located near the structure’s outflow, Davis Pond flow averaged 3,094 cubic feet per second from January 2010 to June 2011 with monthly flow rates varying between 209 cfs and 7,944 cfs.

With the exception of March 2011, southeast Louisiana rainfall monthly totals were below normal from September 2010 through June 2011 (Figure 3.6). Rainfall for July 2011 was 5.4 inches above normal. (Data from the Southern Regional Climate Center).

On July 25, 2010, what was left of Tropical Storm Bonnie made landfall near the southeastern tip of Louisiana as a remnant low pressure system and continued inland over east-central Louisiana with no significant effect on the study area. No other tropical systems have affected the study area since the 2010 stock assessment.

Hackberry Bay POSG salinities from January 2010 to June 2011 averaged 5.7 ppt. with a range of 0.44 to 14.95 ppt. (Figure 3.8). Average for June 2011 was 14.95 ppt. which is well above the June 2001 to 2010 average of 10.7 ppt. (Figure 3.7) (USGS Hackberry Bay constant data recorder).

Salinities in the Barataria Bay POSG have averaged 17.2 ppt. with a range of 8.9 to 23.2 ppt. (Figure 3.8) since January of 2010. The average salinity in June was 8.9 ppt. (USGS Barataria Bay constant data recorder).

Salinities in the Little Lake POSG averaged 4.5 ppt. between January 2010 and June 2011 (Figure 3.8) with a range from 0.53 to 12 ppt. Average June 2011 salinity in the Little Lake POSG was 12 ppt. (USGS Little Lake constant data recorder).

Non-Climatic Events

Deepwater Horizon Oil Spill and Related Response Actions

The BP Deepwater Horizon oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline, including oyster resources. In direct response to the spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessment continues on the direct and indirect impacts of oil and response actions to Louisiana's near shore environment, including to oysters and oyster habitat.

Oyster Larvae and Spat Deployment

A joint effort between LDWF and Louisiana State University (LSU) is producing oyster larvae and spat at the LSU oyster hatchery at LDWF's Fisheries Research Laboratory located on Grand Isle. LSU is developing and testing methods for high density oyster larval production. LDWF has utilized the larvae/spat to develop and test deployment methods of the young oysters onto public oyster areas. Since June 2, 2011 approximately 90 million oyster larvae and 1.4 million spat have been deployed in the Hackberry Bay Public Seed Reservation. All releases to date have occurred over existing cultch plant locations within the bay with the most recent release occurring on August 10, 2011 at the 2004 south cultch plant.

2010/2011 Oyster Season Summary

The 2010/2011 oyster season remained closed in Hackberry Bay. No harvest was observed in the Little Lake or Barataria Bay Public Oyster Seed Grounds (Table 3.3).

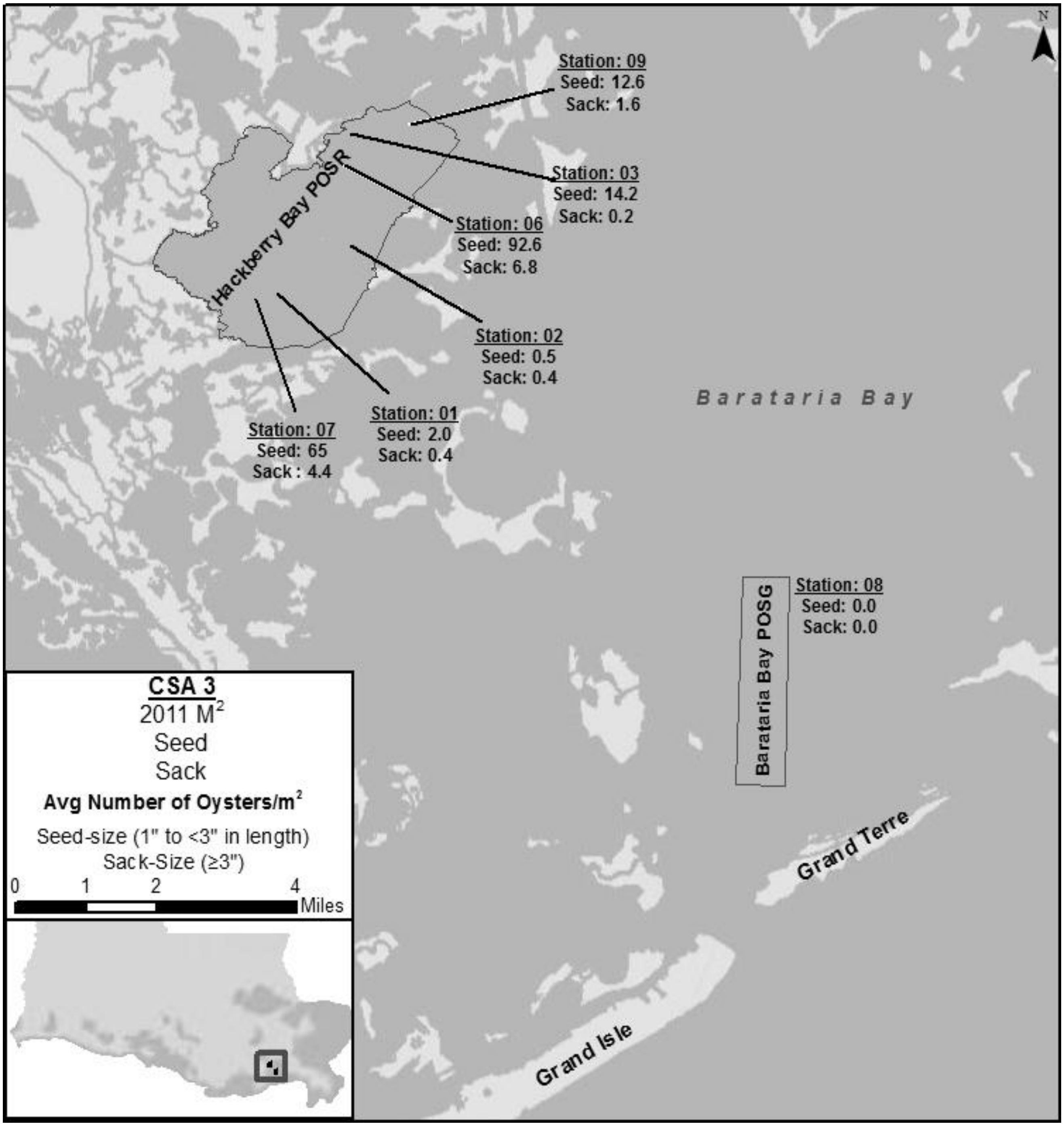


Figure 3.1 2011 Hackberry Bay POSR and Barataria Bay POSG sample results as an average per square meter (SP=Spat, SD=Seed, SK=Sack, and M=Mussels) and map of sample locations.

Table 3.1 2011 square meter results for the Barataria Basin (CSA 3).

Station	No.	Approx Reef Acres	Average Live Seed Oysters / M2	Average Live Sack Oysters / M2	Barrels of Seed Available	Barrels of Sack Available	Oyster Spat/M2
Hackberry Bay 2004 North Cultch Plant	6	10	92.6	6.8	5,204.8	764.4	98.8
Hackberry Bay 2004 South Cultch Plant	7	25	65	4.4	9,133.6	1,236.5	92.6
Hackberry Bay 2008 Cultch Plant	9	50	12.6	1.6	3,541.0	899.3	32.8
Hackberry Bay Existing Reefs	1,2,3	14.7	5.6	0.33	461.8	54.4	19.6
Barataria Bay 2004 Cultch Plant	8	40	0	0	0	0	0
Little Lake		Unknown	Unknown	Unknown	Unknown	Unknown	
Totals		139.7			18,341.2	2,954.7	

	2010	2011	% Change
Seed	5,019.7	18,341.2	+265.4 %
Sack	1,206.7	2,954.7	+144.9%
Total	6,226.4	21,295.9	+242.0%

Table 3.2 2011 square meter predator/mortality results for the Barataria Basin (CSA 3).

Station	No.	Hooked Mussels/m^2	Oyster Drills Present	Spat Percent Mortality	Seed Percent Mortality	Sack Percent Mortality	Seed & Sack Percent Mortality	All Size Percent Mortality
Hackberry Bay 2004 North Cultch Plant	6	106.8	0	6.1	3.1	0	2.9	4.5
Hackberry Bay 2004 South Cultch Plant	7	33.4	0	9.7	3.3	0	3.1	6.5
Hackberry Bay 2008 Cultch Plant	9	6.8	0	10.4	3.1	0	2.7	7.6
Hackberry Bay Existing Reefs	1,2,3	13.5	0	13.3	4.5	0	4.3	11.3
Barataria Bay 2004 Cultch Plant	8	0	0	100	100	na	100	100
Little Lake		Unknown						

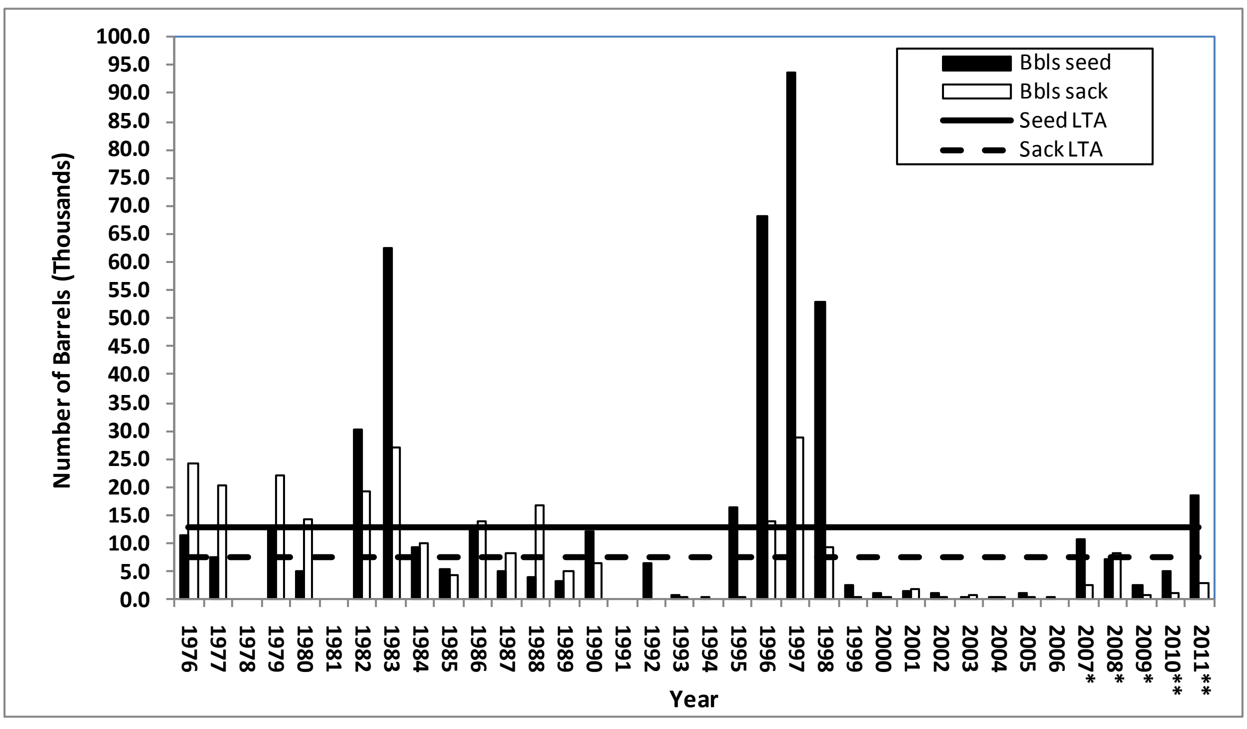


Figure 3.2 Estimated seed and sack oyster availability in the Hackberry Bay Public Oyster Seed Reservation from 1976 to 2011. * includes the 2004 cultch plants **includes the 2008 cultch plant.

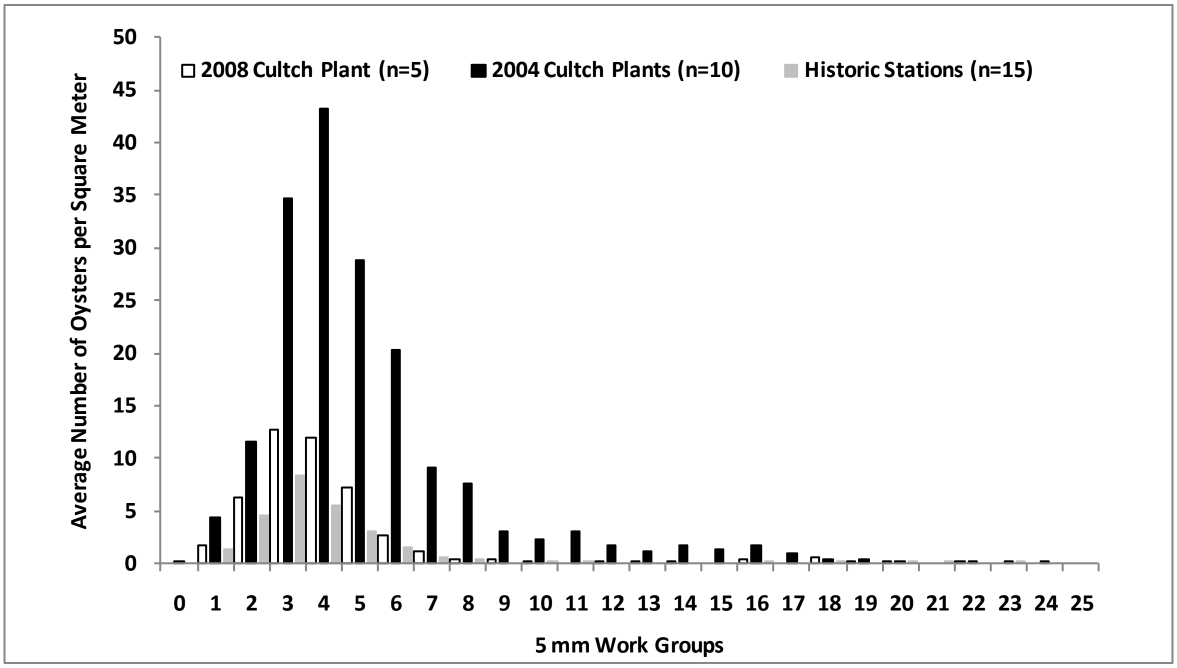


Figure 3.3 Oyster size distribution by 5 mm work groups in square meter samples collected from the Hackberry Bay Public Oyster Seed Reservation during 2011.

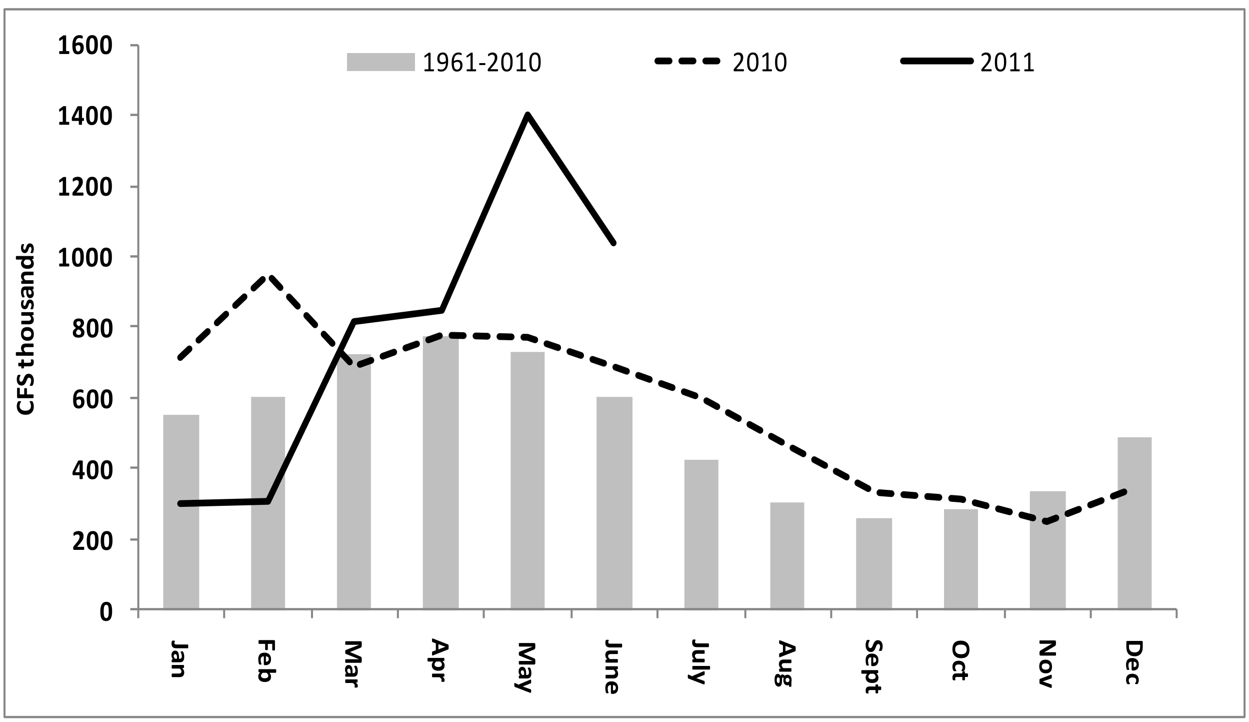


Figure 3.4 Mississippi River discharge in thousands of cfs. Mississippi River discharge data supplied by the United States Army Corps of Engineers (USACE).

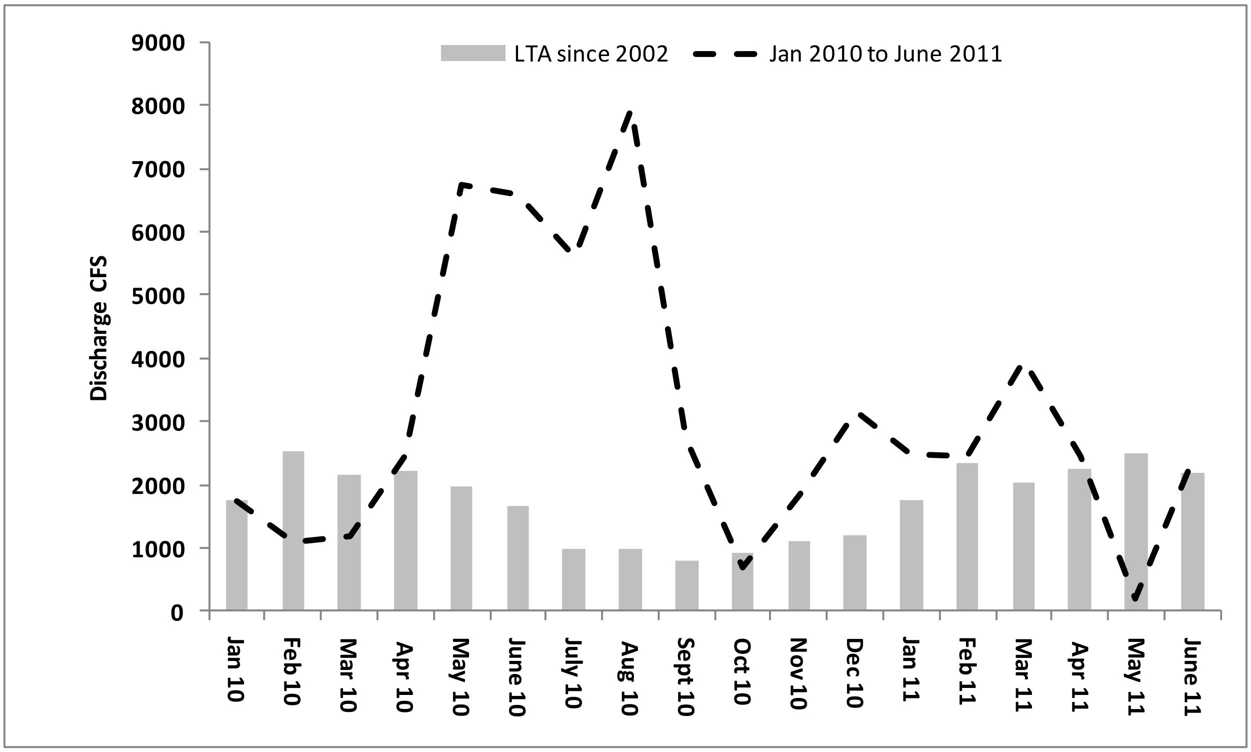


Figure 3.5 Davis Pond flow in cubic feet per second (cfs) Davis Pond discharge data supplied by the United States Geological Survey (USGS) constant data recorder located near the Davis Pond structure.

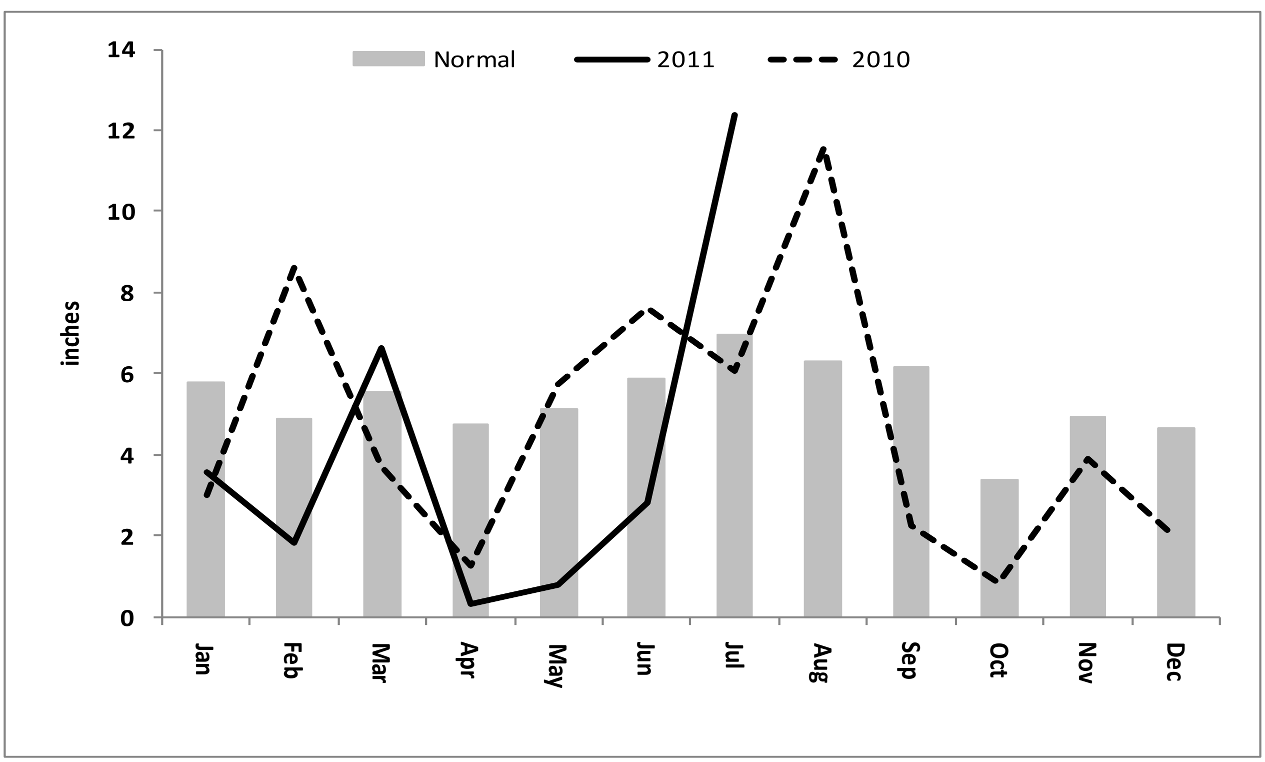


Figure 3.6 Southeast Louisiana monthly rainfall. Data supplied by Southern Regional Climate Center.

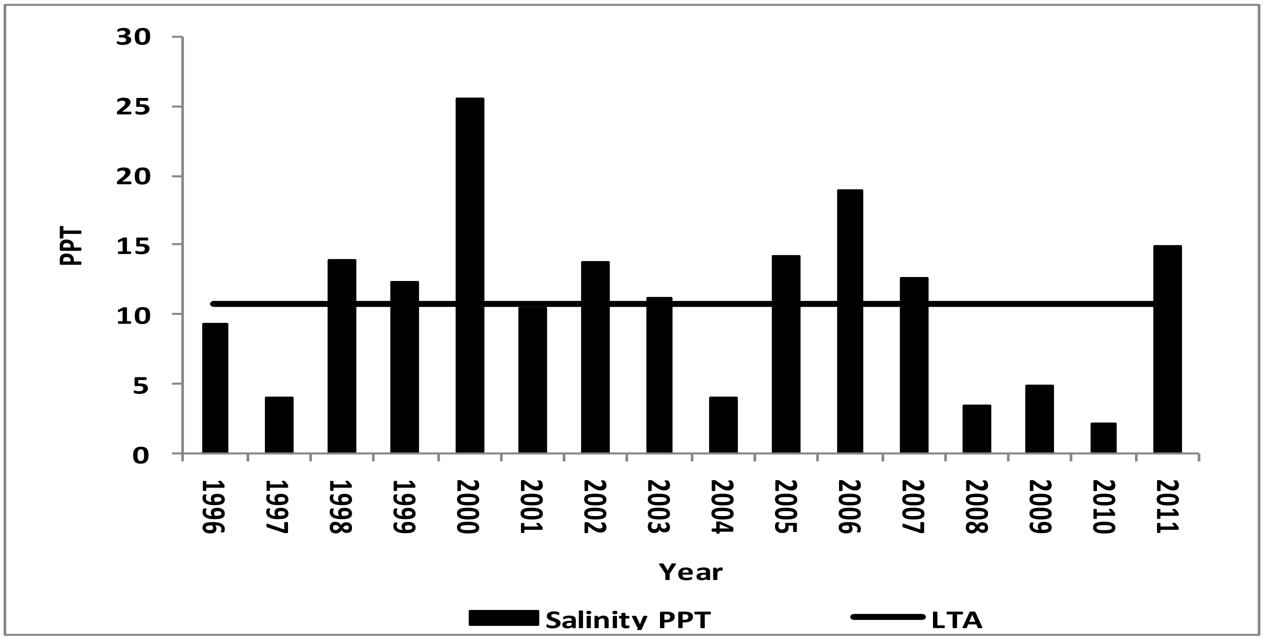


Figure 3.7 Historical average daily June salinity in ppt in Hackberry Bay from 1996-2011. Data supplied by the United States Geological Survey (USGS) constant data recorder located in Hackberry Bay.

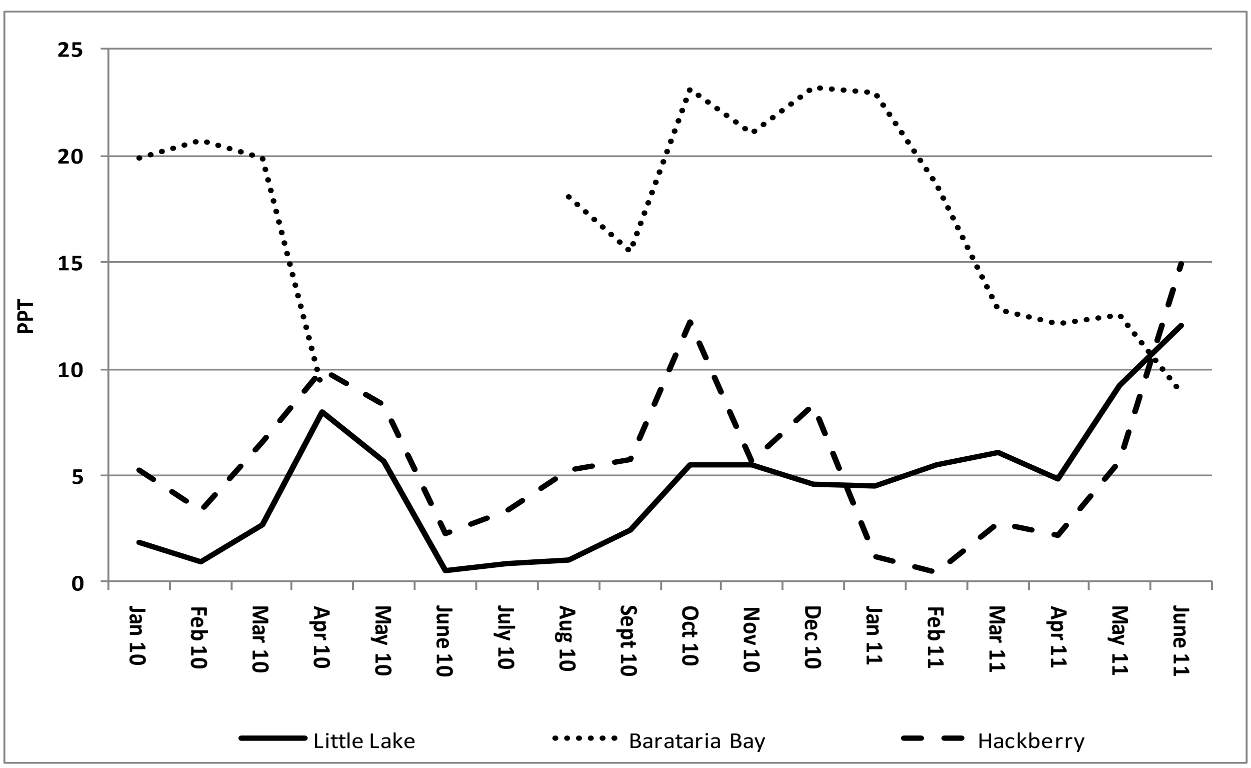


Figure 3.8 Average monthly salinities in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR from Jan 2010 through June 2011. Data from United States Geological Survey (USGS) constant data recorders located in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR.

Table 3.3 Estimates of oyster harvest from the public oyster areas in Coastal Study Area 3 for the 2010/2011, 2009/2010, 2008/2009, 2007/2008, and 2006/2007 season.

Public Oyster Area	Seed Oysters Harvested (BBLS)	Sack Oysters Harvested (Sacks)
2010/2011 CSA 3 Totals	***0***	***0***
2009/2010 CSA 3 Totals	***7,885***	***504***
2008/2009 CSA 3 Totals	***1,985***	***3,270***
2007/2008 CSA 3 Totals	***13,930***	***976***
2006/2007 CSA 3 Totals	***12,190***	***6,091***

Coastal Study Area (CSA) 5 - Oyster Stock Assessment

Introduction

The Terrebonne Basin (TB) historically included Coastal Study Areas (CSA) IV and V, and separate oyster stock assessment reports were completed for each area. The two CSAs were merged in 2010 and renamed as CSA V.

There are currently eight different Public Oyster Seed Reservations (POSR) or Public Oyster Seed Grounds (POSG) within the Terrebonne Basin; these include Sister Lake (Caillou Lake) POSR, Bay Junop POSR, Lake Mechant POSG, Deep Lake POSG, Lake Felicity POSG, Lake Chein POSG, and Lake Tamour POSG. Sister Lake, Bay Junop, and Lake Mechant are located in the western TB while Deep Lake, Lake Felicity, Lake Chein, and Lake Tamour are found in the eastern TB (Figures 5.1 and 5.2).

Sister Lake (Caillou Lake) (Figure 5.1) was designated as a POSR in 1940 and includes 7,752 acres of water bottoms. The first known cultch deposition projects were established here between 1906-1909 by the U.S. Bureau of Fisheries. Subsequent plantings by the State of Louisiana began in Sister Lake in 1917; since then 21 cultch plants totaling 4,562 acres have been made. Recent Sister Lake cultch deposition projects included a 67 acre site in 2004 and a 156 acre site in 2009. A recent 2005 side scan sonar survey in Sister Lake documented a total reef acreage of 2,279 acres, an increase of 45% from the earlier estimate of 1,566 acres.

The Bay Junop POSR (Figure 5.1) was established in 1948 and consists of approximately 2,448 acres of water bottoms. Due to the shallow water depth of the bay and inability of barges and tugs to enter for cultch deposition, no reef-building projects have been implemented in this area to augment natural oyster reef production. Total reef acreage in this bay is estimated at approximately 158 acres.

The Lake Mechant POSG (Figure 5.1), with approximately 2,131 acres of water bottoms, was designated in 2001. In 2004, a 30 acre cultch plant was established. In 2007, approximately 500 acres of unleased water bottoms between the POSG and private oyster leases was added, which increased the total acreage within the public oyster seed ground to 2,631 acres.

The Lake Tambour, Lake Chein, Lake Felicity, and Deep Lake POSGs (Figure 5.2) were established in 2001. These POSGs are located either in a high-salinity zone (where oyster populations are primarily intertidal because of extensive predation) or a wet zone (where subtidal oysters may be found when salinities are lower than normal). The upper portion of Lake Felicity was used as a public seed reservation during the 1940s and early 1950s, but was discontinued because salinities were usually too high for oyster production. However, future planned coastal freshwater diversion projects may return the area to a more favorable salinity regime for oyster production.

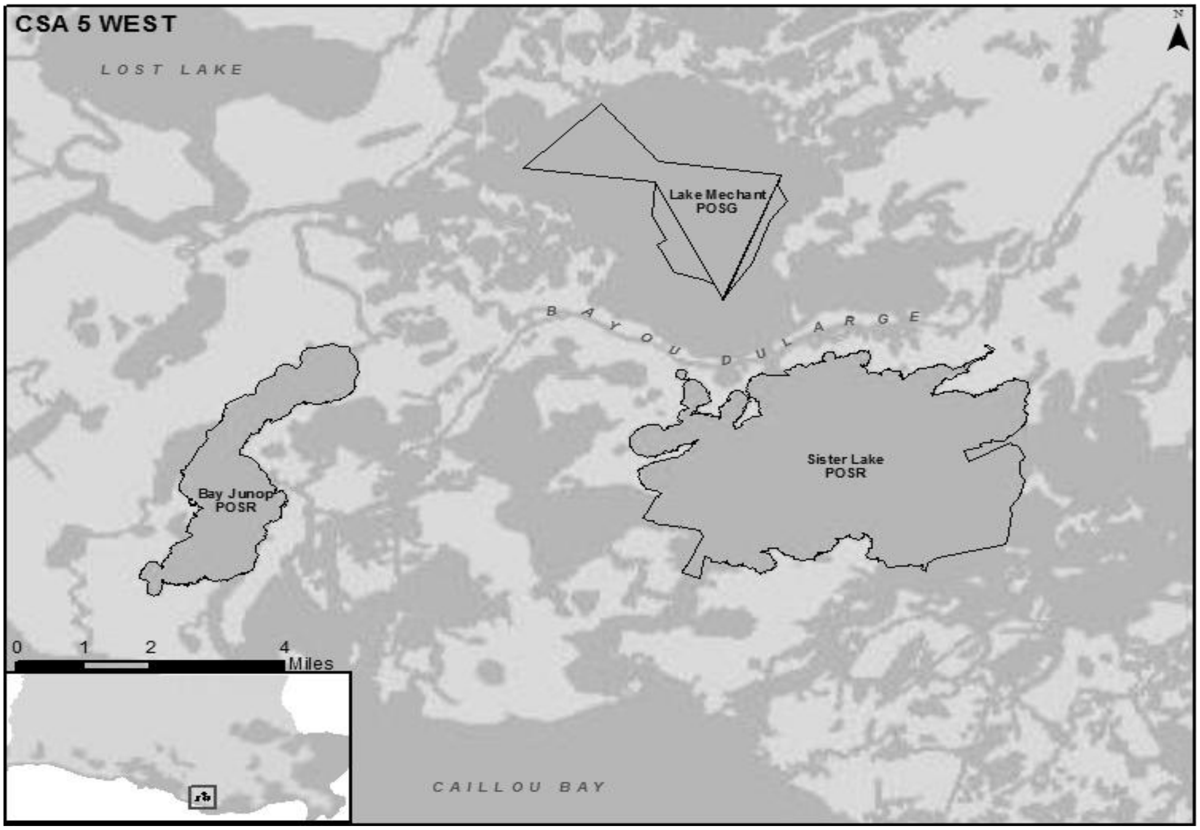


Figure 5.1. Public oyster areas within the western portion of Coastal Study Area (CSA) 5.

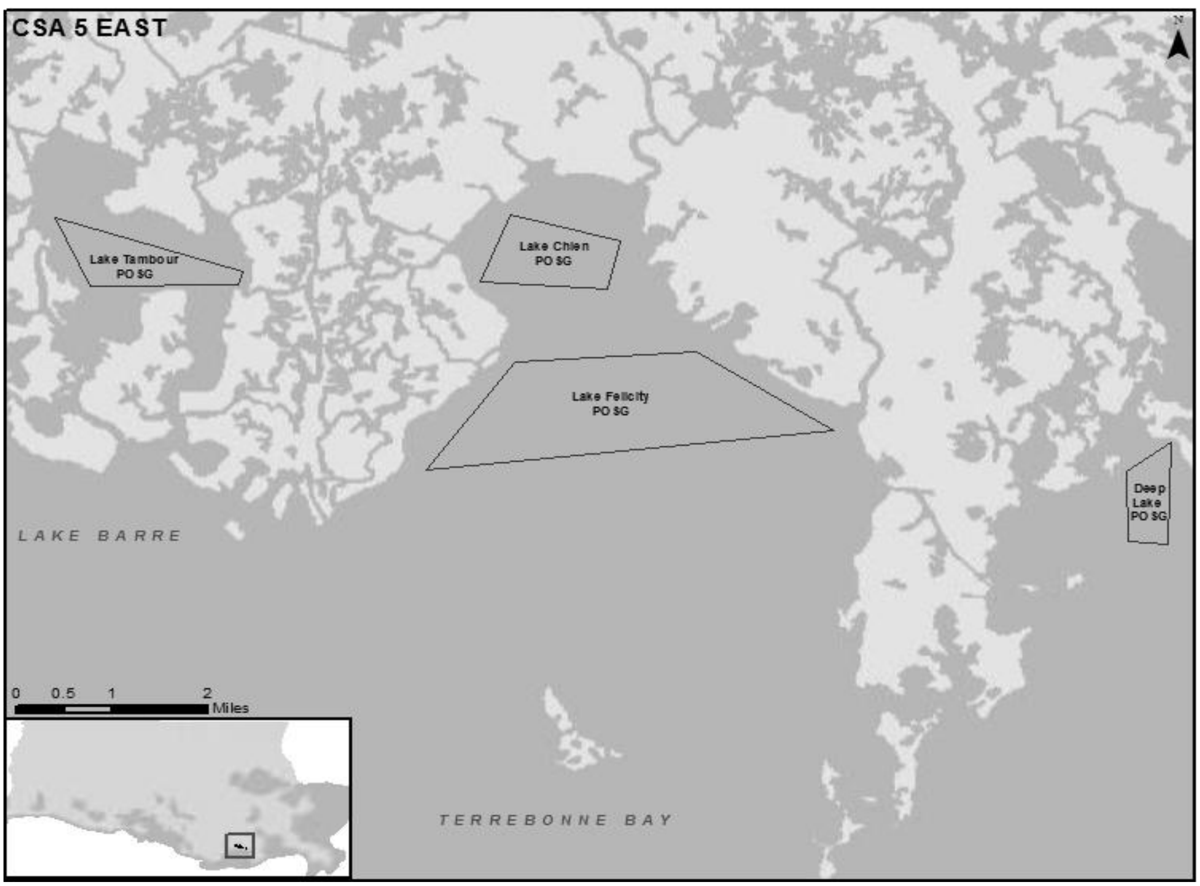


Figure 5.2. Public oyster areas within the eastern portion of Coastal Study Area (CSA) 5.

Lake Chein and Lake Felicity POSGs have three cultch plants. Cultch deposition projects in Lake Chein (15.5 acres) and Lake Felicity (40 acres) were completed in the summer of 2004. Another 22.3 acre cultch plant was created in Lake Chein in May 2009 due east of the initial Lake Chein cultch plant. No reef development projects have been implemented in Lake Tambour or Deep Lake.

Materials and Methods

Square-meter field samples were collected from July 27-29, 2011 on existing oyster reefs in Sister Lake POSR, Bay Junop POSR, Lake Mechant POSG, Lake Felicity POSG, and Lake Chein POSG (Figures 5.1-5.5).

SCUBA divers took five replicate samples at each station using an aluminum square meter frame that was tossed randomly over the station. All oysters, loose shell and other organisms were removed from the upper portion of the substrate. Live and dead oysters, oyster predators, and hooked mussels (*Ischadium recurvum*) were separated and counted. Oysters were measured in 5 millimeter (mm) size groups and subsequently divided into three categories: spat (<25 mm), seed (25-74 mm), and sack (75 mm and larger) oysters. In conjunction with square meter oyster samples, water temperature and salinity data were also taken.

The average number of seed and sack oysters per square meter sample at each station was used to estimate oyster stock availability by extrapolation using known reef acreage.

Results and Discussion

Resource Availability
Estimates of resource availability in 2011 were again below historic means in the western TB but generally increased in the eastern TB (Figures 5.6 - 5.10). The overall 2011 estimated resource availabilities in the Terrebonne Basin POSGs and POSRS are 113,919 barrels of seed oysters and 105,762 barrels of sack oysters (Tables 5.1 – 5.3).

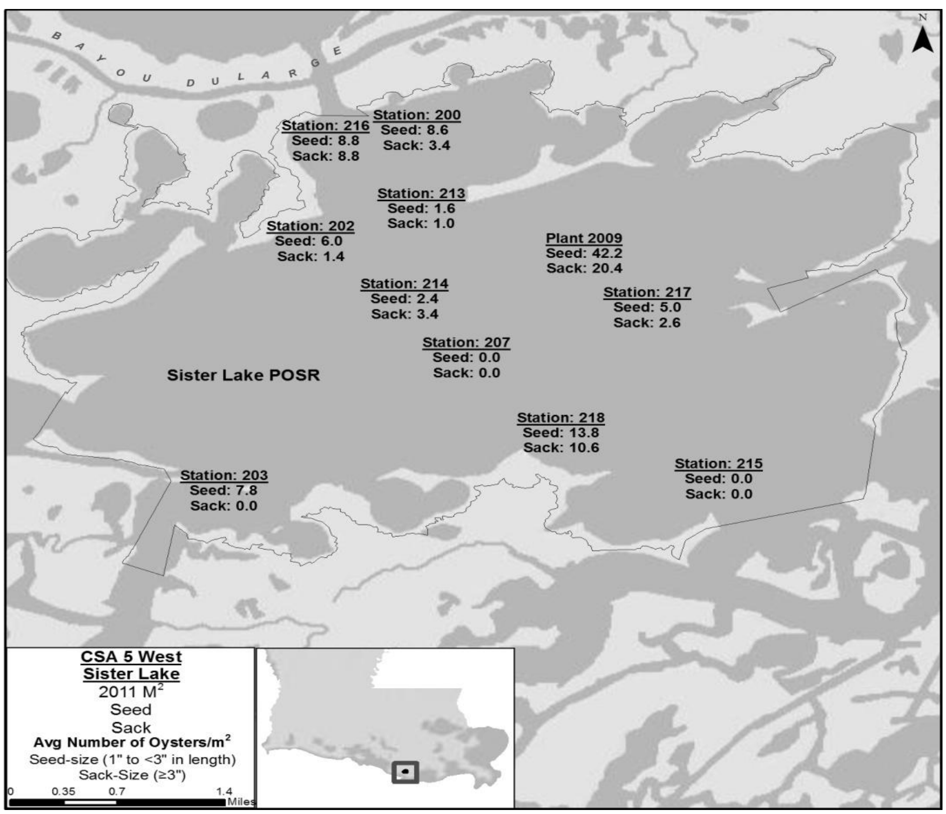


Figure 5.3. Results from each square-meter sampling station within Sister Lake.

These estimates represent declines in oyster stocks from the historic means of -57% for seed and -53% for market-size (sack) oysters. As has been the case in previous years, total oyster stock size in the Terrebonne Basin is driven largely by oyster stock availability in Sister Lake.

Although estimated resource availabilities in Sister Lake was reduced 54% for seed oysters and 48% for market oysters from historic means (Figure 5.6), 2011 estimates of sack oysters was greater than during any year since 2007. The increase in 2011 Sister Lake sack oyster resource availability is partially attributed to the addition of the 2009 156-acre cultch plant, which contributed 37% of the total estimated sack oyster production (Figure 5.3).

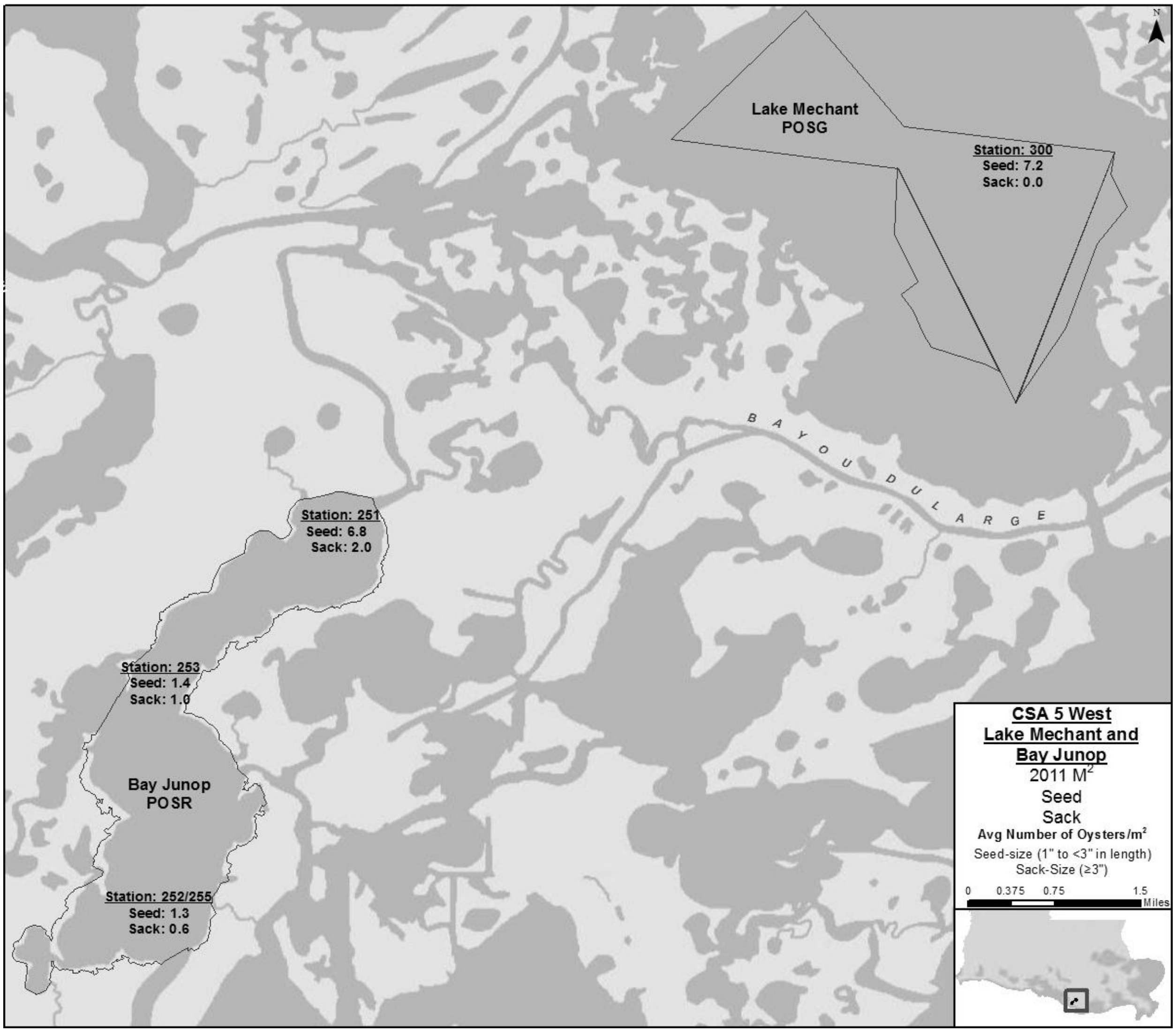


Figure 5.4. Results from square-meter sampling stations within Bay Junop and Lake Mechant.

Spat Production

Numbers of spat increased 82% and 72% from historic means in Sister Lake and Lake Mechant but showed declines of 100% in Bay Junop, 77% in Lake Felicity, 74% in the 2004 Lake Chein cultch plant, and 50% in the 2009 Lake Chein cultch plant.

Hydrological Data
Average salinities and temperatures on the cultch plants associated with May-June oyster dredge samples are provided in Tables 5.4 and 5.5. Mean water temperatures were below average in the western TB and average in the eastern TB. Mean salinities were near average in the western TB but above average in the eastern TB. Salinities in the western TB July square meter samples were substantially lower than May-June dredge samples. Salinity data collected in conjunction with July square meter samples averaged 6.0 ppt, 7.3 ppt, 0.8 ppt, 18.8 ppt, and 17.8 ppt in Sister Lake, Bay Junop, Lake Mechant, Lake Felicity, and Lake Chein, respectively.

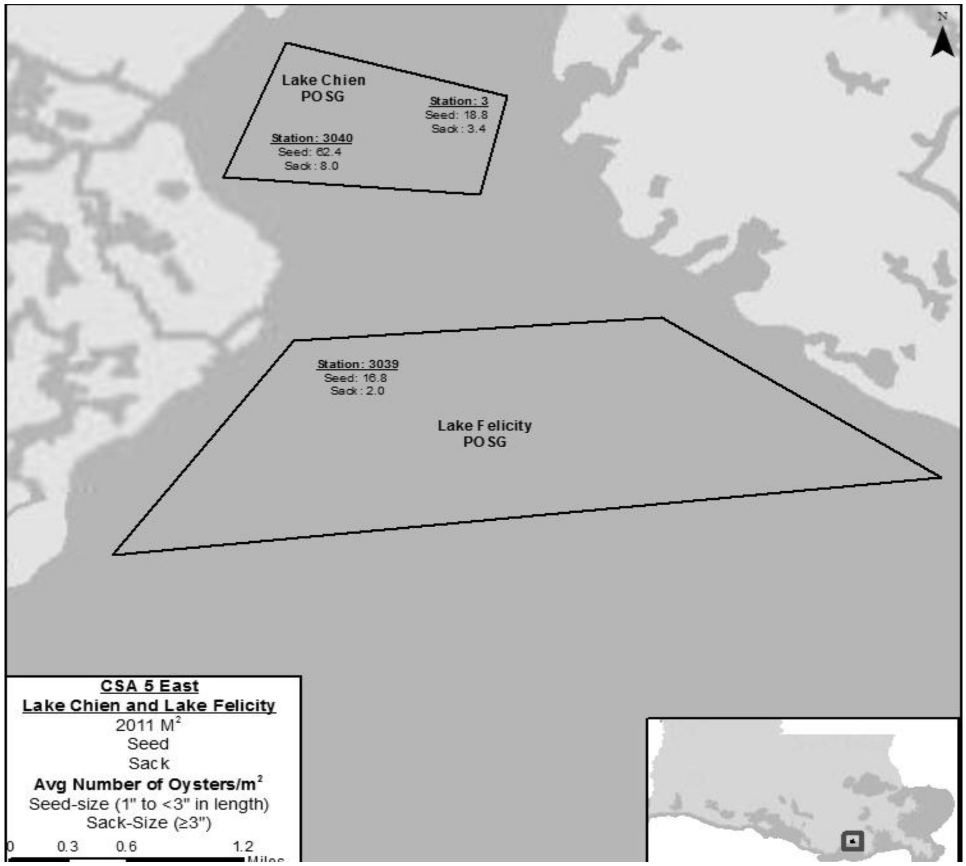


Figure 5.5. Results from square-meter sampling stations within Lake Chien and Lake Felicity.

Mortality
Recent mortalities of spat, seed or sack oysters in square meter samples for 2011 as compared to long-term means are provided in Table 5.6. Except for Lake Mechant, 2011 mortalities of seed and sack oysters declined versus historic means.

Fouling Organisms / Predators / Disease
The only oyster reef associated species collected in square meter samples were hooked mussels and mud crabs (Table 5.7). No predators such as oyster drills (*Stramonita haemastoma*), gulf stone crabs (*Menippe adina*), and blue crabs (*Callinectes sapidus*) were observed.

Dermo (*Perkinsus marinus*), a protozoan parasite found in oysters, may cause extensive oyster mortalities in conditions of high salinities and water temperatures. The results of the Dermo tests from CSA V public oyster areas are included in a separate section.

Deepwater Horizon Oil Spill and Related Response Actions
The BP Deepwater Horizon oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline, including oyster resources. The impacts of oil on oysters resources continue to be of concern. Assessment continues on the direct and indirect impacts of oil and response actions to Louisiana's near shore environment, including to oysters and oyster habitat.

Tropical Weather / Flooding Events
No tropical weather events impacted Terrebonne Parish oyster populations in summer of 2011. Abnormally high river discharges in the Atchafalaya River reduced salinities in western Terrebonne Parish in summer 2011.

2010/2011 Oyster Season Summary

Oyster harvests on the POSGs and POSRs were monitored through boarding reports and trip ticket records. These data were used to calculate annual estimates for each public oyster area (Tables 5.8 and 5.9).

Sister Lake: Sister Lake was closed for the 2010-2011 season.

Lake Mechant: Lake Mechant was open from October 29-31, 2010. Effort was very low because of persistent rough weather conditions and the Department of Health and Hospitals (DHH) seasonal classification closure of the northern portion of the POSG. Eleven boats were observed on opening day, but boarding interviews were cancelled because of extremely rough seas; unfortunately, only two trip tickets were submitted as most fishermen harvested only seed and trip tickets are not required to document seed oyster harvest. The trip ticket data could not be reported because of confidentiality requirements.

Bay Junop: Bay Junop was open from November 15-21, 2010. Fishing effort was very low because of a DHH closure which excluded the majority of the POSR to oyster harvest. Thirteen trip tickets were documented; a total of 433 sacks of oysters were harvested.

Lake Chein / Lake Felicity: Lake Felicity and Lake Chein excluding the 2009 cultch plant were open from November 15-16, 2010. Boarding reports were obtained from vessels in both Lake Felicity and Lake Chein. Eight vessel days of effort yielding 405 sacks of market oysters were documented in Lake Chein. Harvest activity in Lake Felicity included four vessel days of effort producing an estimated 205 sacks of market oysters. With the exception of 2007, total fishing effort was similar to earlier years. Overall production declined after 2007 because of persistent high salinities, continued subsidence of the reef materials, and the detrimental effects of silt overburden from Hurricanes Katrina and Rita in 2005 and Gustav and Ike in 2008.

Table 5.1 2011 Sister Lake Oyster Availability

METER² STATION	HISTORICAL REEF ACREAGE	ADJUSTED REEF ACREAGE*	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
200	221.58	322.40	1,304,707.40	8.6	3.4	15,584.01	12,322.24
202	81.93	119.21	482,420.24	6	1.4	4,020.17	1,876.08
203	151.31	220.16	890,943.57	7.8	0	9,651.89	0.00
207	185.72	270.22	1,093,556.54	0	0	0.00	0.00
213*	96	139.68	565,267.22	1.6	1	1,256.15	1,570.19
214	129	187.70	759,577.83	2.4	3.4	2,531.93	7,173.79
215	81	117.86	476,944.22	0	0	0.00	0.00
216	115	167.33	677,143.02	8.8	8.8	8,276.19	16,552.39
217	438	481.29	1,947,719.51	5	2.6	13,525.83	14,066.86
218	67	97.49	394,509.41	13.8	10.6	7,561.43	11,616.11
2009 cultch plant		156.00	631,312.19	42.2	20.4	37,001.91	35,774.36
TOTAL		**2,123.32**	**8,592,788.98**	**96.2**	**51.6**	**99,409.50**	**100,952.01**

*2005 Side Scan Sonar Survey conducted May 2005 measure Sister Lake acreage to be 2279 acres of reef. This is an increase of 45.5% over prior years' estimates. Starting in 2007, individual site acreage has been adjusted accordingly to reflect this increase of availability.

Table 5.2 2011 Bay Junop Oyster Availability

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
251	17.2	69,606.22	6.8	2	657.39	386.70
252/255	67.36	272,597.37	1.3	0.6	492.19	454.33
253	73.26	296,473.92	1.4	1	576.48	823.54
254**	94.2	381,215.44				
TOTAL	**252.02**	**1,019,892.93**	**9.50**	**3.6**	**1,726.06**	**1,664.57**

** Suspended due to conflict with private lease

Table 5.3 2011 Lake Mechant/Lake Chein/Lake Felicity Oyster Availability

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
300 (Mechant)	30	121,406.19	7.20	0.00	1,214.06	0.00
Felicity	40	161,874.92	16.80	2.00	3,777.08	899.31
Chein 2004	15.5	62,726.53	62.40	8.00	5,436.30	1,393.92
Chein 2009	22.3	90,245.27	18.80	3.40	2,356.40	852.32
TOTAL	**107.8**	**436,252.91**	**105.2**	**13.40**	**12,783.85**	**3,145.54**

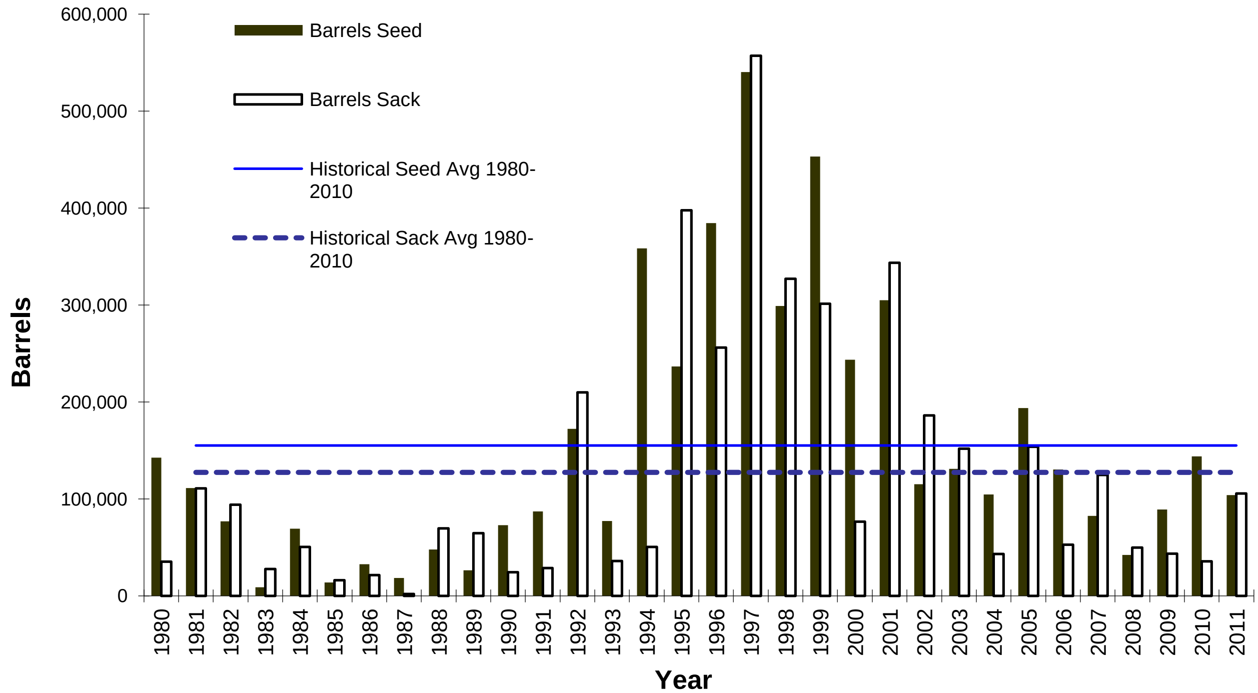


Figure 5.6. Historical oyster stock availability in Sister Lake.

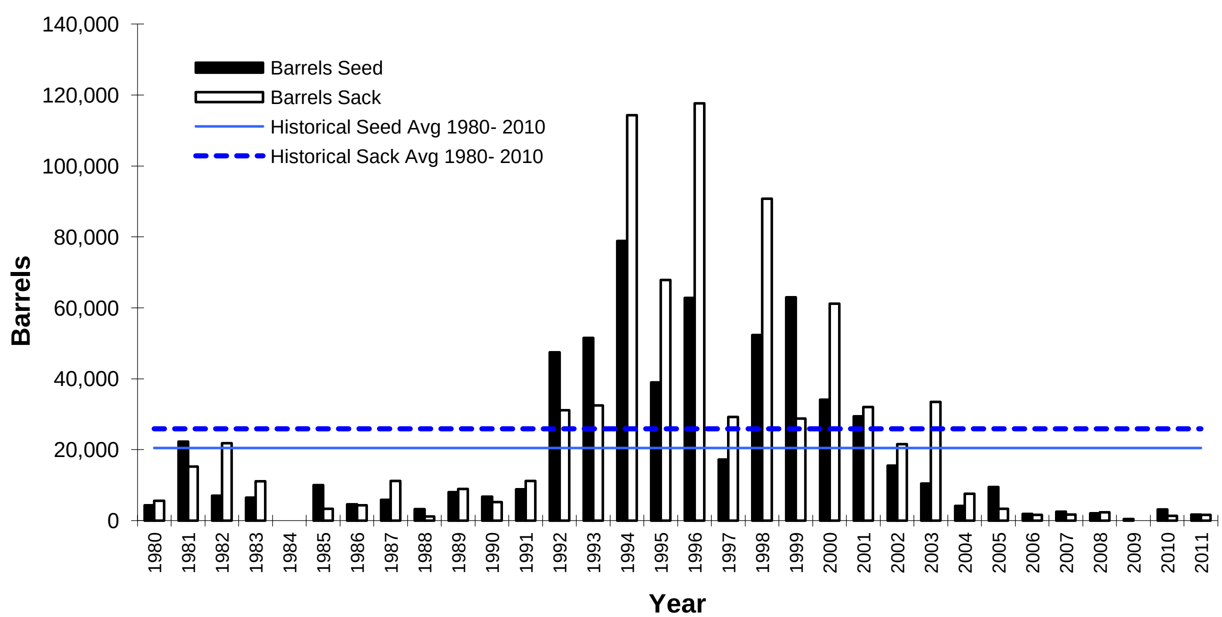


Figure 5.7. Bay Junop historic oyster availability

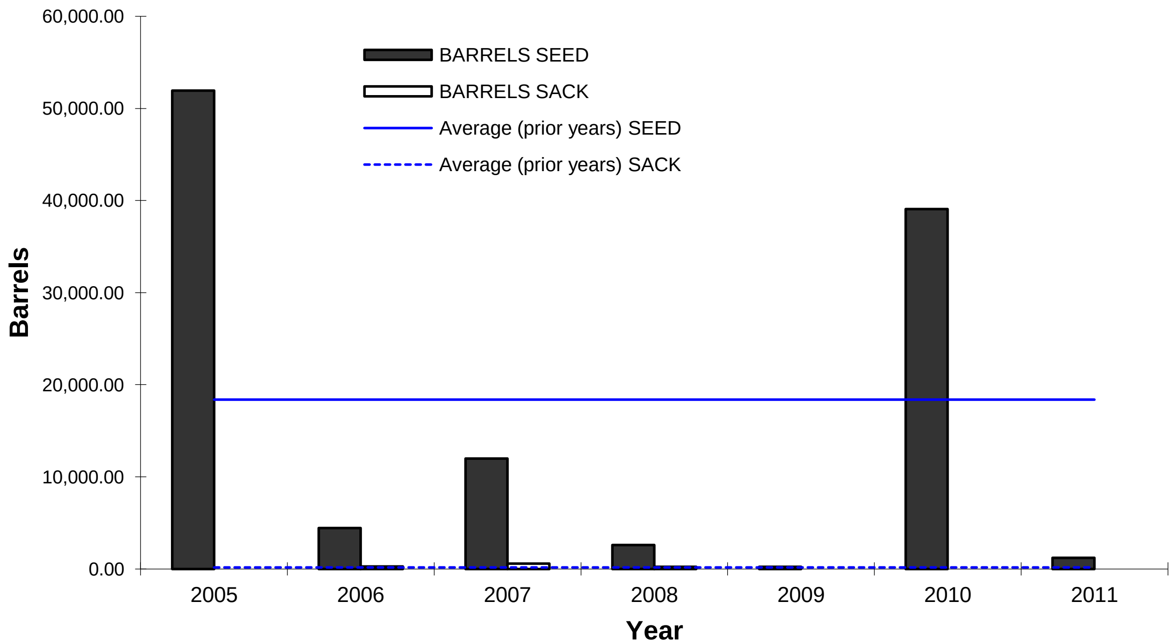


Figure 5.8. Lake Mechant historic oyster availability

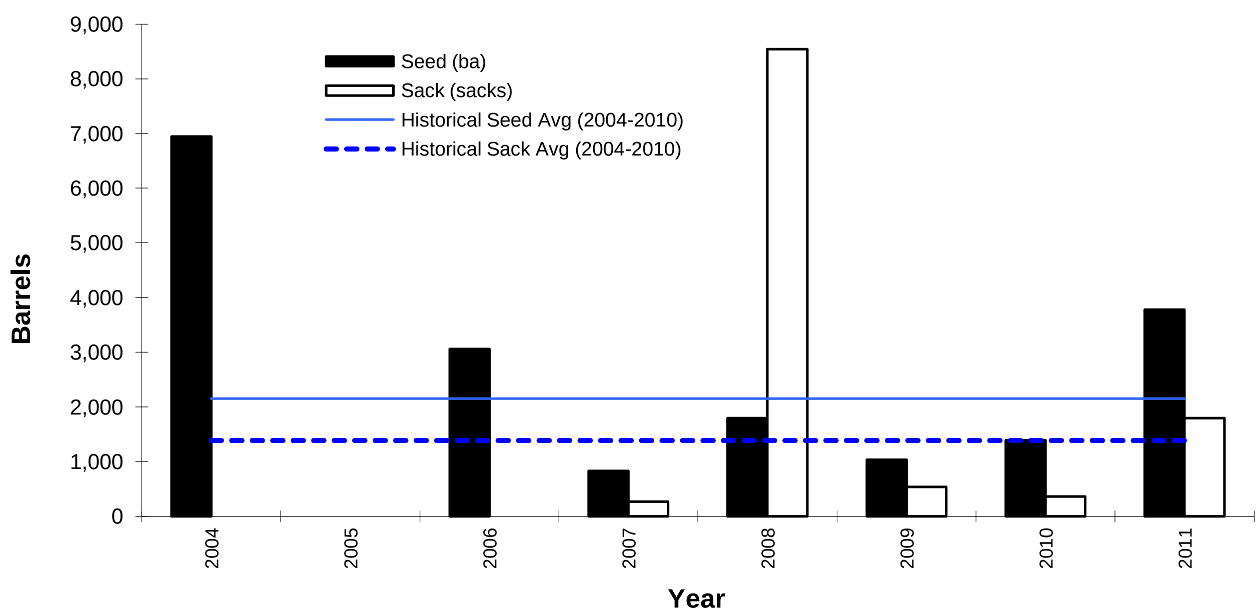


Figure 5.9. Lake Felicity historic oyster availability

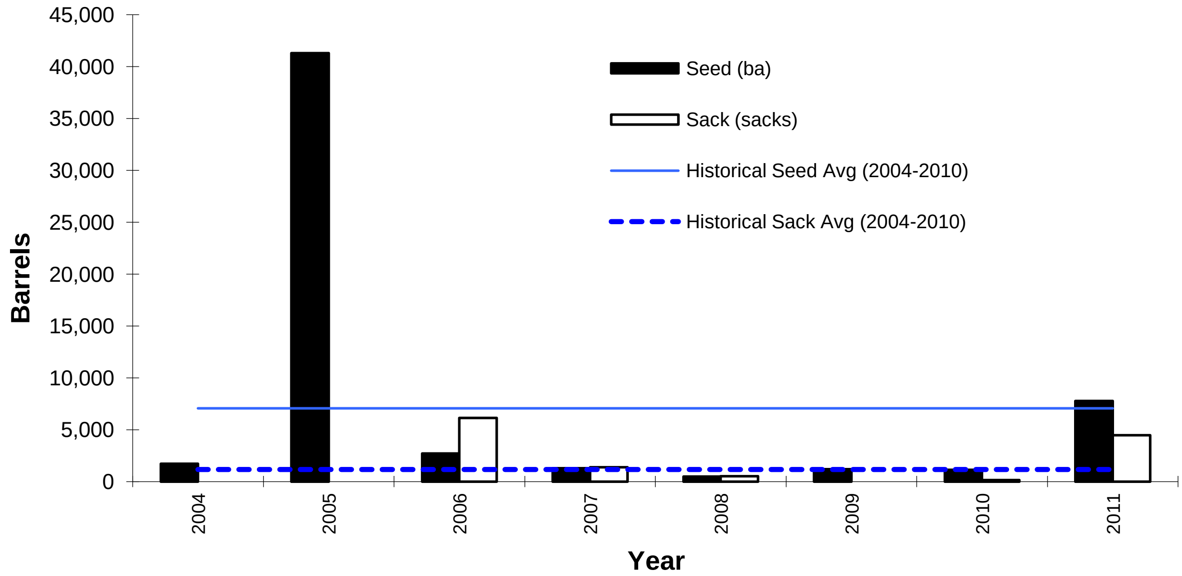


Figure 5.10. Lake Chein historic availability

Table 5.4 Mean May-June and historic means of water temperature (°C) and salinity (ppt) from Sister Lake, Bay Junop, and Lake Mechant dredge samples (X= not designated as seed ground or reservation).

YEAR	TEMPERATURE			SALINITY		
	Sister Lake	Bay Junop	Lake Mechant	Sister Lake	Bay Junop	Lake Mechant
1995	28.2	29.3	X	11.7	18.0	X
1996	28.4	29.4	X	11.6	18.3	X
1997	28.6	27.5	X	3.4	10.7	X
1998	29.0	28.5	X	5.7	11.5	X
1999	26.9	26.9	X	15.1	16.2	X
2000	28.1	29.0	X	20.3	26.6	X
2001	27.1	28.1	X	12.9	14.1	X
2002	28.6	28.5	26.9	12.7	16.3	2.8
2003	28.9	28.9	28.4	11.3	13.6	5.0
2004	28.7	28.4	27.8	14.7	18.8	3.8
2005	28.3	28.2	27.5	16.2	18.5	4.7
2006	28.9	28.3	28.4	17.7	18.4	10.5
2007	27.6	27.5	29.2	19.4	20.0	11.5
2008	28.1	27.9	28.1	6.4	5.7	0.5
2009	29.5	29.2	28.9	10.4	12.1	2.7
2010	28.7	28.1	30.2	17.9	15.5	5.7
2011	**26.5**	**26.6**	**25.7**	**15.3**	**15.6**	**5.4**
Mean	28.2	28.3	28.4	13.1	15.6	5.3

Table 5.5 Mean May-June and historic means of water temperature (°C) and salinity (ppt) from Lake Felicity and Lake Chein dredge samples.

YEAR	TEMPERATURE		SALINITY	
	Felicity	Chein	Felicity	Chein
2006	27.6	27.8	24.9	25.0
2007	27.4	27.6	20.9	20.7
2008	28.2	28.6	16.0	16.0
2009	28.3	28.6	21.3	21.1
2010	29.2	29.5	18.6	17.8
2011	**27.2**	**27.5**	**25.0**	**24.9**
Mean	27.1	27.4	20.3	20.1

Table 5.6. Overall mortalities of seed and sack oysters in 2011 versus historic means by seed ground or reservation (TB=Terrebonne Basin; NA=not applicable).

Region	Seed Ground	Percent Mortality Change	
		Seed Oysters	Sack Oysters
Western TB	Sister Lake	-71	-100
	Bay Junop	-100	-100
	Lake Mechant	+806	NA
Eastern TB	Lake Felicity	-70	NA
	Lake Chein 2004	-100	-100
	Lake Chein 2009	NA	NA

Table 5.7 Average numbers of hooked mussels and mud crabs per sample by seed ground or reservation (TB=Terrebonne Basin).

Region	Seed Ground	Numbers Per Sample	
		Hooked Mussels	Mud Crabs
Western TB	Sister Lake	8.5	0.9
	Bay Junop	2.4	0.6
	Lake Mechant	2.6	0.2
	Overall	6.6	0.8
Eastern TB	Lake Felicity	0	1.2
	Lake Chein 2004	1.4	2.8
	Lake Chein 2009	0.6	2.2
	Overall	0.7	2.1

Table 5.8 Annual totals and long term means of commercial seed oyster (barrels) and sack oyster (sacks) harvests from Sister Lake, Lake Mechant, and Bay Junop (NS=no season; X=not designated as seed ground or reservation).

YEAR	SISTER LAKE		BAY JUNOP		LAKE MECHANT	
	Seed	Sack	Seed	Sack	Seed	Sack
1995	51,160	48,824	NS	NS	X	X
1996	20,055	40,019	3,770	26,908	X	X
1997	31,668	43,727	NS	NS	X	X
1998	15,228	16,510	6,205	20,345	X	X
1999	29,934	47,586	NS	NS	X	X
2000	NS	NS	NS	NS	X	X
2001	18,183	34,060	NS	NS	X	X
2002	NS	NS	40	1,031	X	X
2003	11,840	92,580	NS	NS	X	X
2004	NS	NS	5	2,623	0	2,211
2005	3,200	81,788	NS	NS	NS	NS
2006	NS	NS	10	3,890	NS	NS
2007	16,960	42,514	NS	NS	19,665	132,703
2008	600	5,530	0	737	NS	NS
2009	4,610	13,676	NS	NS	NS	NS
2010	NS	NS	0	433	0	91
MEAN	18,494	42,438	1,433	7,995	6,555	45,002

Table 5.9. Annual totals and long term means of seed oyster (barrels) and sack oyster (sacks) harvests from Lake Felicity and Lake Chein cultch plants (NS=no season; X=not designated as seed ground or reservation).

YEAR	LAKE FELICITY		LAKE CHIEN 2004		LAKE CHIEN 2009	
	Seed	Sack	Seed	Sack	Seed	Sack
2005	15	0	252.5	0	X	X
2006	0	0	1,940	0	X	X
2007	470	4,830	2,157	2,439	X	X
2008	0	0	205	17.2	X	X
2009	NS	NS	NS	NS	NS	NS
2010	0	205	0	405	NS	NS
MEAN	97	1,007	911	572	0	0

Coastal Study Area (CSA) 6 – 2011 Oyster Stock Assessment

Introduction

Oyster reefs found in the Vermilion/East and West Cote Blanche/Atchafalaya Public Oyster Seed Ground generally fall within the boundaries of Coastal Study Area 6 (CSA6). The inside oyster seed ground, promulgated by the Louisiana Wildlife and Fisheries Commission in 1990, consists of that portion of state water bottoms found generally north of a line from the western shore of Vermilion Bay and Southwest Pass eastward to Point Au Fer. The outside area, designated in 1988, consists of Louisiana State Territorial Waters from the private oyster lease boundary near Mound Point/Marsh Island eastward to Point Au Fer. Since 1986 (prior to the official designation of these areas as seed grounds), LDWF managed the oyster resources found on local state water bottoms in a manner similar to present seed ground management procedures. This allowed limited harvest/relays from the Vermilion Bay area reefs when hydrological conditions and oyster abundance and distribution permitted.

The Vermilion/Cote Blanche/Atchafalaya Bays Complex is a large, primarily open-water brackish system with the area seed grounds consisting of approximately 541,787 water bottom acres. Primary influences on the bays dynamic salinity regime are the Gulf of Mexico, Atchafalaya River and the adjacent Wax Lake Outlet, and the Vermilion River. In general, the public oyster seed grounds within CSA 6 are highly influenced by freshwater discharge from the Atchafalaya River. Typically, oyster reproduction occurs in the fall after the river stage abates, with oysters growing to seed size (1 inch to < 3 inches) by the following spring. However, spring and early summer floodwaters depress salinities, placing extreme physiological stress on the organisms. These low salinities, coupled with high water temperatures through the summer months, typically results in extensive oyster mortalities on the public grounds. Occasionally, however, reduced freshwater inflow from the Atchafalaya River leads to higher-than-normal salinities and the normal annual cycle of extensive oyster mortalities is broken, leading to a harvestable population of seed oysters during the following oyster season (September through April). Such was the case in 2000, 2001, 2005, 2006, and 2007 when sizeable quantities of seed oysters were available for harvest.

An overall Vermilion Bay area stock assessment is not possible at this time, as figures relative to oyster reef sizes are not available. However, data collected from this year's sampling program will be compared to previous years' data, with a look at hydrologic conditions, marine fouling, and oyster predators on sampled reefs. The effects of extended high Atchafalaya River levels during the period of March 2011 through July 2011 will be addressed. In addition, information regarding the 2010/2011 oyster season harvest on the Vermilion Bay area public oyster seed grounds will be presented.

Methods

As a result of the implementation of LDWF's expanded Fisheries Inshore Monitoring Program, additional square meter field sampling locations were added to the historically designated sites on the inside and outside areas of the Vermilion, East and West Cote Blanche and Atchafalaya Bays Public Oyster Seed Ground. The addition of the new sites achieved an improved spatial distribution of sampling effort on the hard-bottom areas found within the system. Field sampling was conducted July 18 through July 20, 2011. A total of ten stations (Figure 6.1 and 6.2) were sampled with five replicate samples collected at each station. Upon reaching the designated site, the square meter frame was randomly thrown onto the oyster reef. A SCUBA diver removed all oysters, associated macroscopic organisms, and loose surface shell within the frame. All live oysters, and shells from recently dead oysters, were counted, measured in five millimeter (mm) intervals, then classified as spat (<25 mm), seed (25 mm to < 75mm), or sack oysters (≥75mm). Shells from recently dead oysters were defined as "box" (both valves attached) or "valve" (one valve). Oyster size was determined by measuring the "straight-line" distance from the hinge to the apex of the shell. Live predators and fouling organisms were counted. Cultch type and reef condition were noted.

Results and Discussion

Seed and Sack Stock

Live seed-sized oysters were found at the Indian Point, Lighthouse Point and Bayou Blanc sites, with replicates averaging 0.8, 1.6, and 0.8 oysters respectively. No live seeds were taken at the remaining seven sites. Similar to last year's survey, the majority of the seed size oysters were found at sample sites in the vicinity of Southwest Pass. Only one sack sized oyster was collected during the 2011 meter square sampling program, with that specimen taken at the Indian Point site (Figures 6.1 and 6.2).

Low production years associated with extended periods of high Atchafalaya River output are not uncommon on the seed grounds of this bay system. Near 100% mortality on the grounds was noted as recently as 2002, 2003, 2004, 2008, 2009, 2010, and 2011.

Spat Production

Despite the presence of suitable substrate at all locations, only a single spat was collected during the 2011 square meter sampling effort. This single specimen was found at the Lighthouse Point site, located in southeastern Southwest Pass adjacent to the leased area (Figure 6.1). Low spat productivity during periods of high Atchafalaya River flow (with associated low salinity conditions) are common.

Fouling organisms

A decrease in hooked mussel *(Ischadium recurvum)* productivity compared to last year's assessment was documented at the historical sites in the eastern part of the system and at Big Charles north of Southwest Pass. A slight increase was noted at the Indian Point site. Mussel numbers at the new sample sites were not found to be high, with many of the mussels very small, likely a result of the low salinity conditions seen throughout the system again this year (Table 6.1).

Oyster Predators

No evidence of the southern oyster drill *(Stramonita haemastoma)* was noted in any of the square meter samples, which is not surprising considering the depressed salinities in this area. These predatory marine snails are more often associated with higher saline waters where they are known to prey heavily on oysters and other bivalve species. A general increase in the number of mud crabs *(Xanthidae sp.)* was observed at all sites compared to last year's assessment. They were found at all stations except Middle Reef. No blue crabs *(Callinectes sapidus)* or stone crabs *(Menippe adinia)* were captured in the samples.

Disease

Due to the lack of live oysters of appropriate size, no sample was collected from the eastern part of the system for the analysis of the presence of pathogens. A sample was collected from the Indian Point site in southwestern Vermilion Bay and forwarded to Dr. Tom Soniat for quantification of the infestation rate of the protozoa *Perkinsus marinus* (commonly known as Dermo). Results of Dermo analysis are contained within a separate section of this document.

Mortality

The oyster resource found in the area is highly vulnerable to low salinity/high turbidity conditions often seen as a result of extended freshwater conditions associated with high Atchafalaya River discharge. Independent of local rainfall, rising water levels at the Butte La Rose gauge can generally be tied to falling salinity levels in the Vermilion Bays complex. This correlation was documented for the spring/early summer of 2011 (Figure 6.5), with its effects on local oysters noted in this year's assessment.

Though very few seed or sack-size oysters were present in the eastern part of the system following the summer 2010 mortality event, dredge samples taken subsequent to last year's stock assessment indicated a positive spat set at the end of August. Indian Point in Vermilion Bay held promising numbers of seed and a few sack-sized oysters as well. Continued monitoring found that conditions throughout the complex were conducive to oyster productivity until the end of February 2011, with growth and increasing numbers noted at the historical sites and several of the new locations as well. Middle Reef (south of South Pt/Marsh Island), Indian Point, and Lighthouse Point were especially promising.

A dramatic increase in Atchafalaya River flow, beginning in March 2011, began to push fresh and turbid water into the system. By the end of April salinity averaged less than 2.0 parts per thousand (ppt) at sampled dredge sites. On May 14, the US Army Corps of Engineers opened the Morganza Spillway flood-control structure (the trigger to open the spillway is a projected Mississippi River water flow rate of 1.5 million cubic feet per second past Red River Landing above Baton Rouge) to allow excess flow into the Atchafalaya River basin. Water diverted from the Mississippi into the spillway merges downstream with the Atchafalaya floodway before flowing into the Vermilion/Atchafalaya Bays system via the main river channel, the Wax Lake Outlet, or the various water ways that empty into the bays from the Gulf Intracoastal Waterway (GIWW). The spillway remained open at some level for 54 days, with a peak operational flow rate of 182,000 cfs diverted into the basin. The gauge height at Butte La Rose peaked at 23.1 feet on May 27, a height not seen since 1964. A decrease in the number of live oysters collected in dredge samples on the seed ground was noted as water temperatures began to rise in June, with continued mortality in July resulting in few live oysters collected in the 2011 stock assessment effort (Figures 6.1 and 6.2).

Actual recent mortality documented in July 2011 square meter samples was found primarily in the western part of the system, as near complete mortality had occurred at the eastern sites during the preceding months. Dredge samples taken in late June found 100% mortality at the South Point, Bayou Blanc, Rabbit Island, and Middle Reef sites. The only live oyster found in the eastern area was collected at North Reef near Mound Point/Marsh Island. While reefs in the vicinity of Southwest Pass had fared better during June, significant loss of live resource was documented in July dredge samples. Continued mortality was noted at these sites during the square meter assessment, when Big Charles and Lighthouse Point had recent mortality levels of 100% and 74% respectively. It should be pointed out that documentation of recently dead oysters for this area is difficult, as the valves are readily separated in the high energy environment and fouling in the turbid, highly organic water is almost instantaneous.

The cycle of recovery from a distressed resource resulting from low salinity/high water temperatures each summer to positive productivity as salinity rises and water temperatures fall in autumn is very common in this system. As occurred in the spring of 2011, the resource becomes stressed as the rising river lowers salinity and raises turbidity levels. Oysters are then hit by rising summer-time water temperatures, leading to a loss in available resource and completion of the cycle. Although Atchafalaya River stages reached a very high level at the end of May 2011, the duration of the high water period may have a more significant impact on low salinity induced stress in this system. The river stage at Butte La Rose remained well above the long-term average until the end of July (Figure 6.5), contributing to a delay in the normal rise in salinity levels seen with a falling river. Monthly average salinity collected at the Indian Point location started to rise (from its low of 1.8 ppt.) a full month later than usually recorded at this site (Figure 6.4). The residual effect that this delay may have on spat set success and subsequent growth and viability will be monitored through continued dredge sampling until next year's square meter assessment.

Tropical and Climatic Events

No tropical storms or significant climatic events affected the Vermilion area seed grounds since the 2010 assessment.

DWH Oil Spill and Related Response Actions

The BP Deepwater Horizon oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline, including oyster resources. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessment continues on the direct and indirect impacts of oil and response actions to Louisiana's near shore environment, including to oysters and oyster habitat.

2010/2011 Oyster Season Summary

Methods

Roving surveys on portions of the seed grounds with "OPEN" designation under DHH's classification system and areas under DHH relay permit are made to obtain fishery dependent data (i.e. harvest estimates). Fishermen working the seed ground are surveyed and asked to provide estimates of past and current catch rates as well as an estimate of future fishing effort. These data are summarized weekly to maintain a cumulative estimate of harvest for specific reef complexes. Trip ticket data is analyzed to provide additional harvest information.

Results & Discussion
The Vermilion/East and West Cote Blanche/Atchafalaya Bay Public Oyster Seed Grounds opened one-half hour before sunrise on November 15, 2010 and remained open until one-half hour after sunset on April 1, 2011.

An estimated 3,775 sacks were taken from the areas seed ground, with the majority harvested from reefs north of Southwest Pass in Vermilion Bay. No harvest of seed oysters was observed or reported.

Station	Station Name	Latitude	Longitude
002	Big Charles	29.614	-91.986
003	Indian Pt	29.625	-92.008
004	Vermillion Bay	29.686	-91.901
020	Sally Shoal	29.654	-91.871
022	Lighthouse Pt.	29.579	-92.034

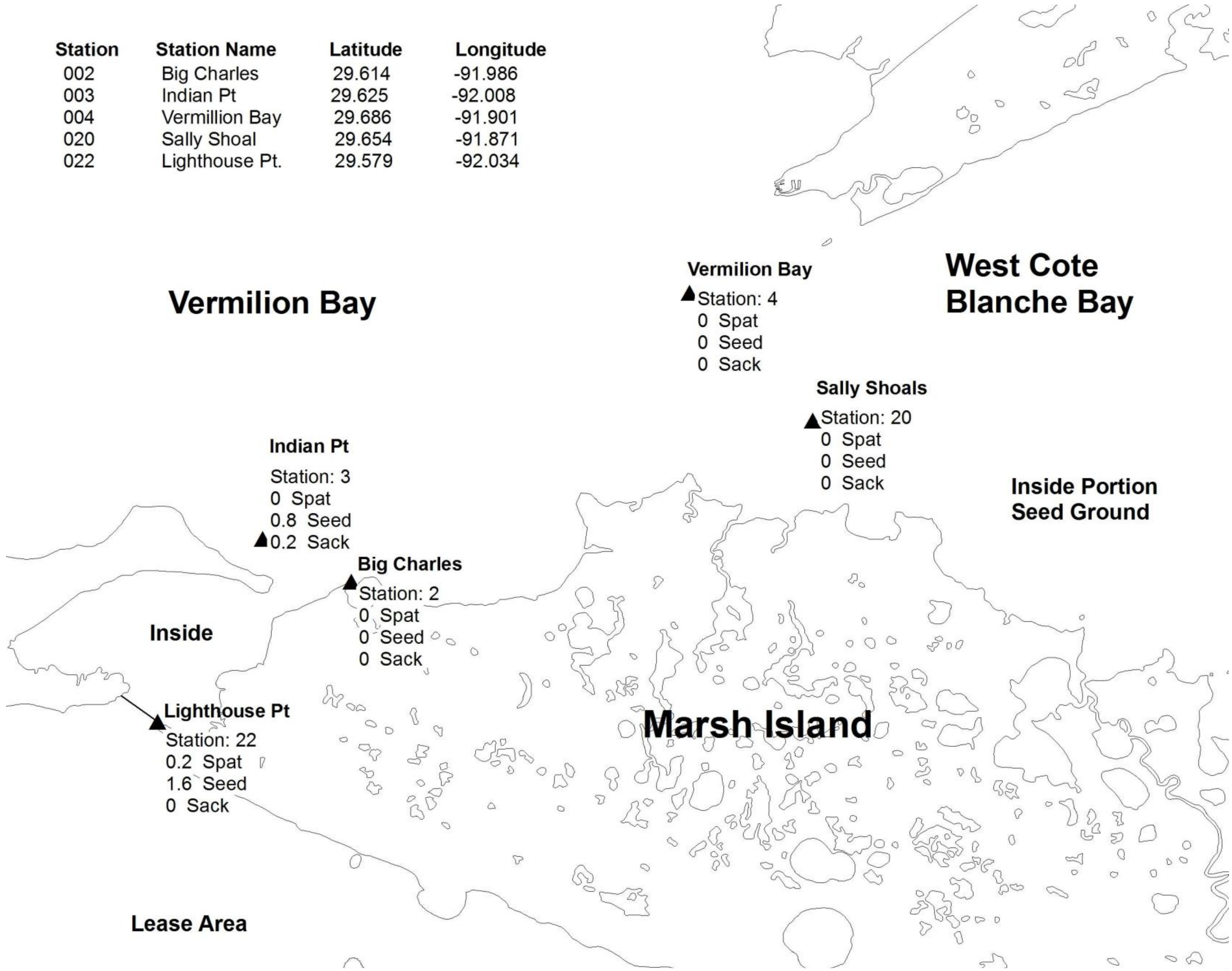


Figure 6.1. Map designating CSA 6 2011 oyster square meter stations in the western part of the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data below station numbers represent average spat, seed and sack oysters per square meter sample.

Station	Station Name	Latitude	Longitude
001	South Pt.	29.483	-91.758
005	Bayou Blanc	29.513	-91.758
021	Rabbit Island	29.511	-91.597
023	Middle Reef	29.452	-91.723
024	North Reef	29.478	-91.808

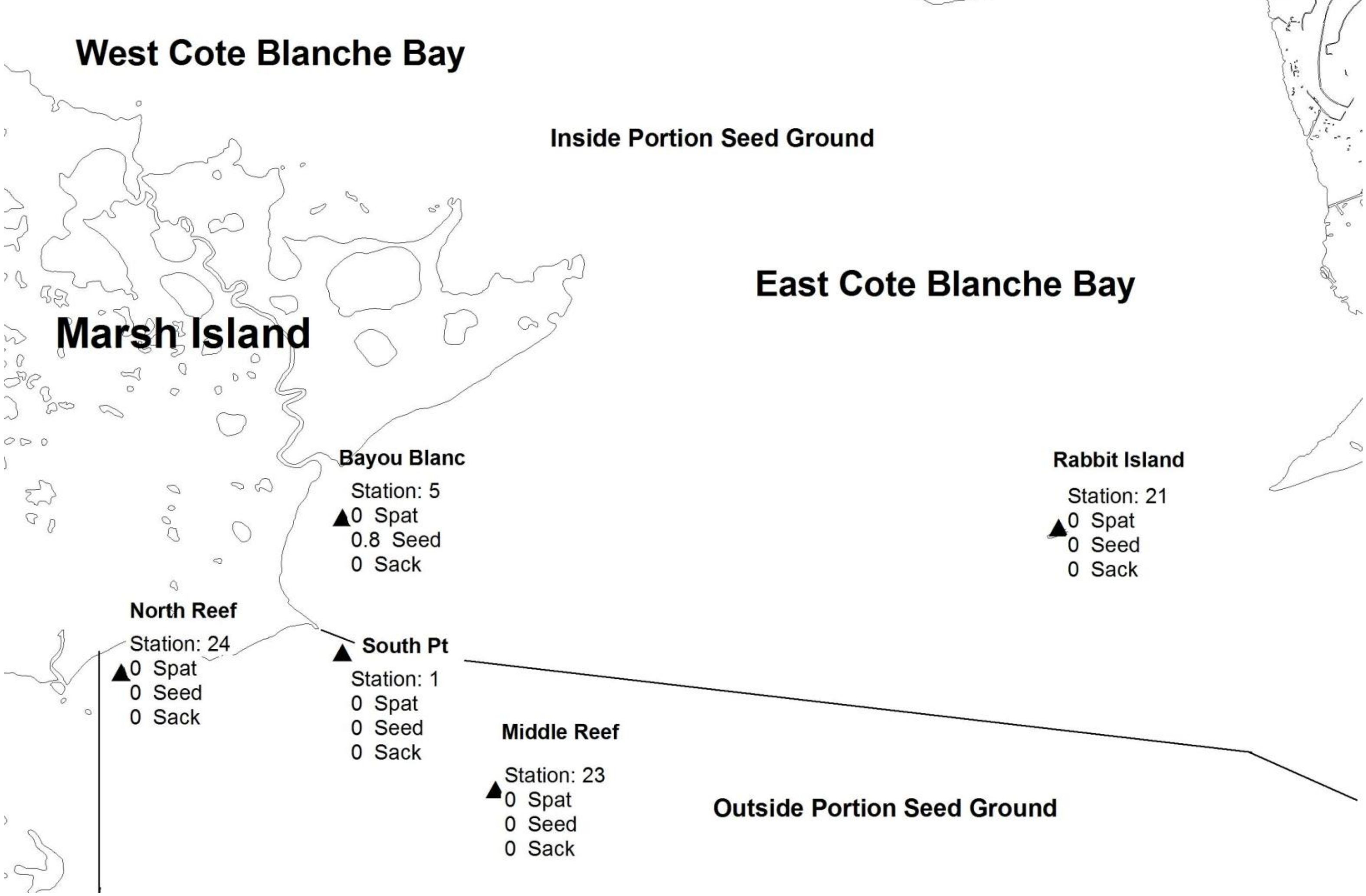


Figure 6.2. Map designating CSA 6 2011 oyster square meter stations in the eastern part of the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data below station numbers represent average spat, seed and sack oysters per square meter sample.

Year	Mean density seed/sample	Mean density sack/sample	Seed/sack ratio
1999	5.5	0.2	27.5:1
2000	81.4	3.3	24.7:1
2001	28.8	4.8	6.0:1
2002	2.25	0.25	9.0:1
2003	1.2	0	No Sack Oysters
2004	4.3	0	No Sack Oysters
2005	14.8	0	No Sack Oysters
2006	16.1	0.5	32.2:1
2007	11.6	0.8	14.5:1
2008	0.3	0	No Sack Oysters
2009	3.4	0	No Sack Oysters
2010	0.8	0.12	6.7:1
2011	0.32	0.02	16.0:1

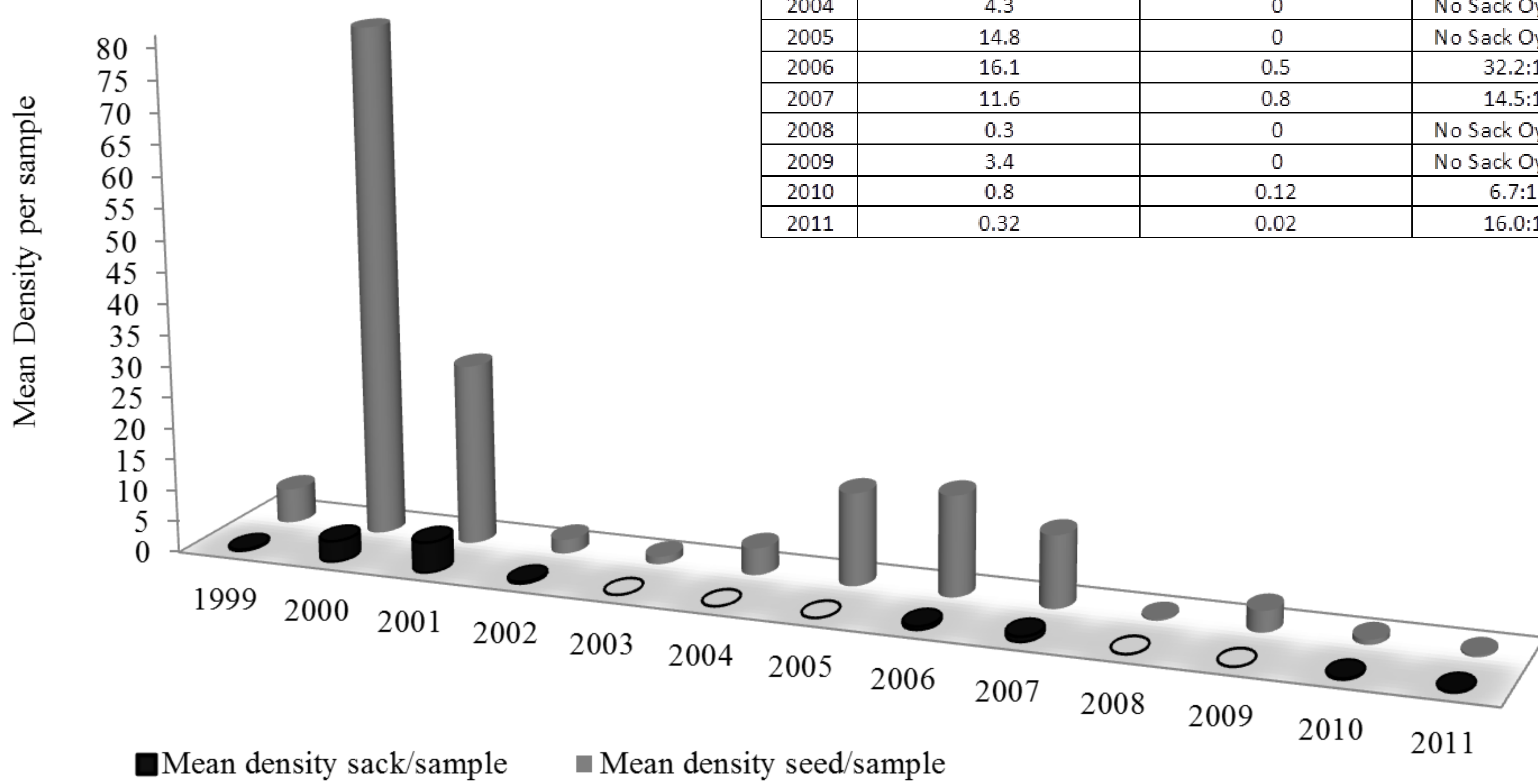


Figure 6.3. Graph depicting mean density of live seed and sack size oysters collected in CSA6 square meter samples (by year). Data table included.

Table 6.1. Mean density of the hooked mussel, *Ishadium recurvum*, recorded at each CSA6 square meter station (by year).
** 2011 was the first year for square meter samples for these stations*

Station no.	Station name	2006	2007	2008	2009	2010	2011
001	South Pt./Marsh Island	16	26.0	1.0	0.0	11.2	1.4
002	Big Charles	17	16.0	2.5	0.0	18.4	5.2
003	Indian Point	9	33.5	0.5	16.0	18.2	20.4
004	Dry Reef/Vermilion Bay	0	0	2.0	37.0	0	6.6
005	Bayou Blanc	7	18.5	2.5	0.0	4	2
020*	Sally Shoals	*	*	*	*	*	3.8
021*	Rabbit Island	*	*	*	*	*	0
022*	Lighthouse Point	*	*	*	*	*	11.8
023*	Middle Reef	*	*	*	*	*	0.2
024*	North Reef	*	*	*	*	*	4.4

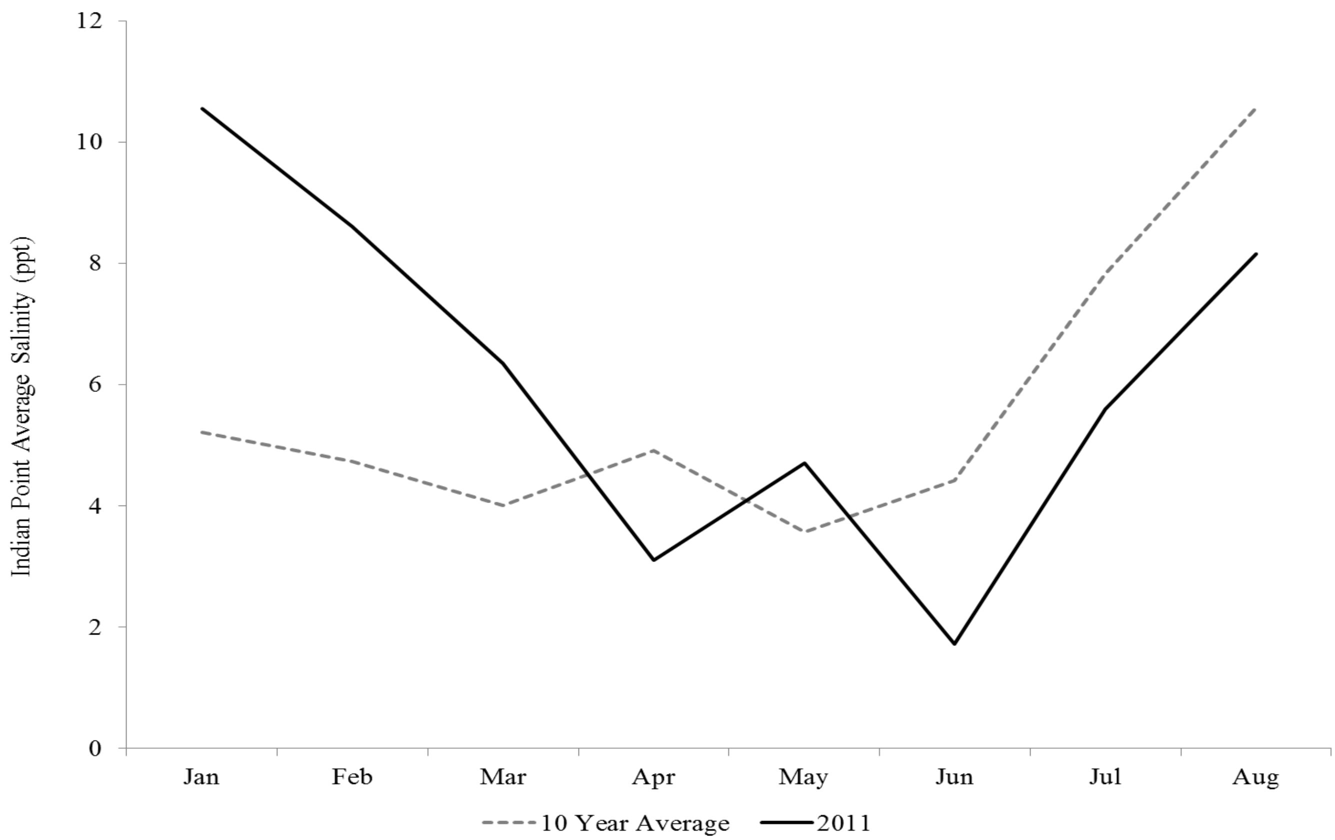


Figure 6.4. Graph depicting average monthly salinity levels measured at the Indian Point site (station 003) for the period January through August.

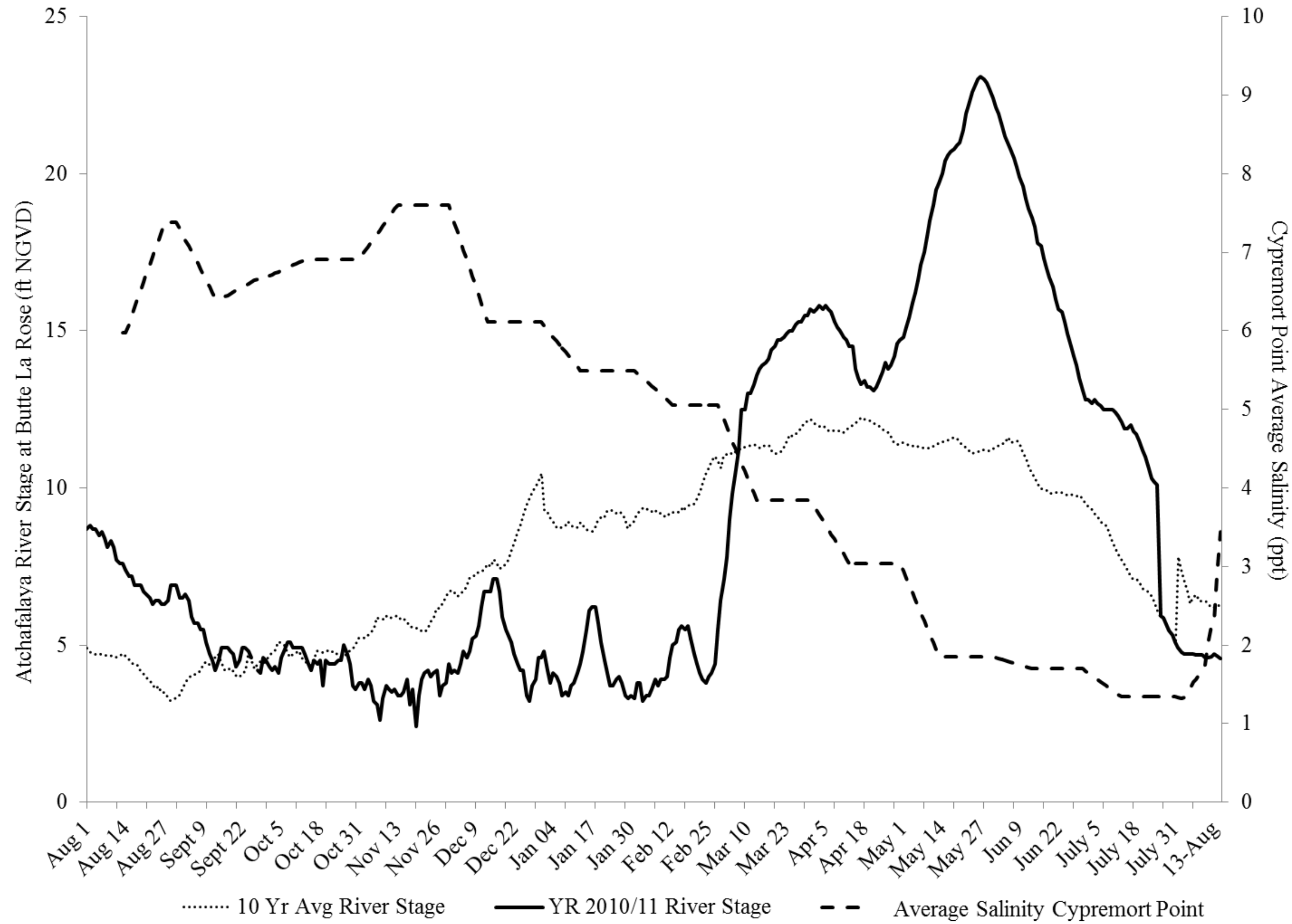


Figure 6.5. Graph depicting Atchafalaya River levels at Butte La Rose gauge and average salinity for Cypremort Point, LA during the period August 1, 2010 through August 15, 2011. Ten year average monthly river stage at Butte La Rose is included.

Coast Study Area (CSA) 7 – 2011 Oyster Stock Assessment

Introduction

Louisiana Department of Wildlife and Fisheries' (LDWF) Coastal Study Area VII is located in Southwest Louisiana, from the Louisiana/Texas state line to Freshwater Bayou in Vermilion Parish. It is comprised of Calcasieu and Mermentau River basins and the eastern portion of the Sabine River Basin. Calcasieu Lake is located at the southern end of the Calcasieu River basin in Calcasieu and Cameron parishes. It consists of approximately 58,260 water bottom acres with oyster reefs located throughout the lake, especially in the southern end. The Mermentau River basin has no oyster harvesting areas. Sabine Lake is located at the southern end of the Sabine River basin in Calcasieu and Cameron parishes. It consists of approximately 90,000 water bottom acres with approximately 31,800 acres in the Louisiana portion and the remainder in the Texas portion. Oyster reefs are located mainly in the very southern portion of the lake.

Oyster seasons in Calcasieu Lake occurred prior to 1967, but were closed from 1967 through 1974. Oyster harvesting resumed in 1975 with only taking by hand or tongs allowed. In 2004, legislation was passed allowing for the use of hand oyster dredges of three feet wide or less in Calcasieu Lake. In 2006, legislation (HB802; ACT398) was passed allowing the use of mechanical retrieval systems for the dredges.

Oyster seasons in Sabine Lake haven't occurred since the early 1960's based on anecdotal information; neither Texas nor Louisiana can document harvest beyond that time and no concrete harvest data has been located.

For assessment purposes, Calcasieu Lake has always been divided into two areas – Eastside and Westcove (the Calcasieu Ship Channel being the dividing line). In 1992, Louisiana Department of Health and Hospitals (LDHH) also divided the lake into two separately managed areas – Calcasieu Lake Conditional Managed Area (CLCMA) and West Cove Conditional Managed Area (WCCMA), (Figure 7.1). When this change occurred the two areas were also managed for health related closures based on river stage of the Calcasieu River at Kinder, LA. CLCMA would close when the river stage reached to 12 feet and the WCCMA would close when the river stage reached 7 feet. Once the river fell below these levels for 48 hours the LDHH would reopen the areas for harvest. LDHH changed the CLCMA river stage threshold in 1998 to 13.5 feet. In 2004 LDHH changed CLCMA to Growing Area (GA) 29 and WCCMA to GA30.

LDHH also limited the amount of acreage available to oyster harvest on the Eastside due to water quality standards. Oysters can only be harvested in the southern portion of the area where water quality meets minimum standards. The total area has been changed several times over the years with the current acreage being approximately 14,743 water bottom acres. LDHH cleared an additional 11,993 acres for oyster harvesting in GA29 (Figure 7.1) for a total of 26,736 water bottom acres. Oyster harvesting in this additional area began on March 4, 2011. GA30 has remained the same at approximately 9,248 acres. The Louisiana portion of Sabine Lake (GA 31) has approximately 31,800 water bottom acres. This area was cleared by LDHH in March of 2011 for harvesting, but LDWF has not opened a season on this area at this time. Since it is cleared for harvesting by LDHH, LDWF has added the area to be assessed for oyster stocks.

Historical reef acreage for all of Calcasieu Lake is 1,690.95. West Cove consists of 726.98 acres and the Eastside consists of 963.97 acres. The historical reef acreage on the Eastside is made up of reefs that fall both within and outside of the conditional managed area. Therefore, assessments of oyster stock sizes are based on total reef acreage within the lake and not just that portion of reef acreage that lies within areas accessible to commercial fishing.

LDWF contracted ENCOS, Inc. to perform a comprehensive water bottom assessment of a portion (approximately 10,421 of 52,878 acres) of Calcasieu Lake in the latter half of 2008. GA29 assessment indicates 4,034.9 acres of Type II bottom (moderately firm mud, firm mud, and buried shell) and 1434.3 acres of Type IIIB bottom (slightly covered buried shell and exposed reef). Type IIIB bottom was further categorized into: Reef, 1,003.8 acres and Exposed Shell, 430.5 acres. GA30 assessment indicates 2,190.0 acres of Type I (soft mud) bottom, 289.0 acres of Type II bottom, 2,472.8 acres of Type IIIB bottom. Type IIIB bottom was further categorized into: Reef, 396.6 acres and Exposed Shell, 2,103.2 acres. Sabine Lake was also assessed by ENCOS, Inc. in 2008 (approximately 11,405.1 of 31,800 acres). GA31 assessment indicates 6,125.2 acres of Type I bottom and 3,800.4 acres of Type II bottom and 2,520.5 acres of Type IIIB bottom. Type IIIB was categorized further into: Reef, 1,041.0 acres and Exposed Shell, 438.5 acres (Figures 7.2 and 7.4)

LDWF contracted Bio-West, Inc. in early 2011 to perform a water bottom assessment of the remaining (those areas cleared by LDHH for oyster harvesting) portion of GA29 (19,772 acres) and GA30 (3,935 acres). GA29 assessment indicates approximately 16,433 acres of Type I bottom, 2,811 acres of Type II bottom and 528 acres of Type IIIB bottom. The Type IIIB bottom was categorized further into: Reef, 432 acres and Exposed Shell, 96 acres. GA30 assessment indicates approximately 1,882 acres of Type I bottom, 1,138 acres of Type II bottom and 915 acres of Type III bottom. The Type IIIB bottom was broken down further in Reef, 750 acres and Exposed Shell, 165 acres (Figure 7.2).

For the 2011 LDWF stock assessment and all future LDWF assessments, unless another water bottom assessment is performed, all the assessments will be figured using a combination of acreages from the ENCOS, Inc. and Bio-West, Inc. assessments. GA29 will have 1,435.8 acres of Reef and 529.5 acres of Exposed Shell. GA30 will have 1,119.6 acres of Reef and 2,268.2 acres of Exposed Shell. GA31 will have 1,041 acres of Reef and 438.5 acres of Exposed Shell (Tables 7.1, 7.2 and 7.3).

LDWF placed a 14.3 acre cultch plant in the southern portion of GA 30 (on the south side of the "Old Revetment") in May of 2009. No oystering was allowed by the Louisiana Wildlife and Fisheries Commission (LWFC) during the 2009-2010 and 2010-11 seasons on this cultch plant. This area was included in the Reef acreage of the Bio-West water bottom assessment.

Methods

The oyster assessment for Calcasieu Lake was derived by taking "meter square" samples. A one meter square frame is randomly tossed in the vicinity of the sample station located on known reef or exposed shell bottom. There are five replicate samples taken by a SCUBA diver at each station and there are six stations in GA29, four in GA30 and six in GA31 (Figures 7.1, 7.2, 7.3, and 7.4). The diver removes all live and dead oysters and shell on the top portion of the reef substrate. Any live and recent dead oysters are measured in five millimeter (mm) groups and divided into three categories – spat (<25mm), seed oysters (25mm – 74mm) and sack oysters (75mm and larger). Oyster predators and Hooked mussels

(*Ishchadium recurvum*) that were collected were identified and tallied. As no bedding (seeding) operations occur in Calcasieu Lake and all harvest is for direct market, the results of data collected are reported in sacks rather than barrels (two sacks equals one barrel).

Results

Growing Area 29

The oyster assessment for GA29 indicates 27,014.5 sacks of sack oysters and 52,838.6 sacks of seed oysters available (Table 7.1). The sacks of sack oysters available on the Reef Bottoms are 25,824.1 and the amount on the Exposed Shell Bottoms are 1,190.4 (Table 7.1).

Sack oysters showed an increase of 14.7% over the 2010 assessment of 23,540.1 sacks (Table 7.4). The availability of seed oysters showed an increase of 518.3% over the 2010 assessment of 8,545.3 sacks (Table 7.4).

Growing Area 30

The oyster assessment for GA30 indicates 594,744.1 sacks of sack oysters and 308,927.2 sacks of seed oysters available (Table 7.2). The sacks of sack oysters available on the Reef Bottoms are 145,993.1 and the amount on the Exposed Shell Bottoms are 448,751.0 (Table 7.2).

Sack oysters showed a decrease of 13.7% over the 2010 assessment of 689,375.7 sacks (Table 7.4). The availability of seed oysters showed a decrease of 49.0% over the 2010 assessment of 605,983.5 sacks (Table 7.4).

Growing Area 31

The oyster assessment for GA31 indicates 1,031,976.2 sacks of sack oysters and 406,141.1 sacks of seed oysters available (Table 7.3). The sacks of sack oysters available on the Reef Bottoms are 937,334.6 and the amount on the Exposed Shell Bottoms are 94,641.6 (Table 7.3).

Sack oysters showed an increase of 115.5% over the 2010 assessment of 478,985.9 sacks (Table 7.4). The availability of seed oysters showed a decrease of 6.9% over the 2010 assessment of 436,409.4 sacks (Table 7.4).

2009 Cultch Plant

The oyster assessment for the 2009 cultch plant indicates the presence of spat, seed and sack oysters. Sampling indicates that there are 173,609 spat, 771.6 sacks of seed oysters and 578.7 sacks of sack oysters available.

The 2011 spat assessment is down considerably from the 2010 assessment of 1,342,585. The 2010 assessment of seed oysters is also down from the 2009 assessment of 24,434 sacks.

Total mortality on the cultch plant was 40.0%.

Discussion

Sack Oysters

The overall assessment is down 12.7% from the 2010 assessment in Calcasieu Lake (GA29 and 30). Though there was a slight increase in oysters in GA29, this was offset by a 13.7% decrease in oysters in GA30 (Table 7.4). The continued low amount of sack oysters in GA29 and high demand is a continued concern.

GA30 will need to be watched closely; the assessment indicates a high number of oysters, but when broken down by bottom type the assessment indicates 145,993.1 sacks of available on the Reef Bottoms and 448,751.0 sacks available on the Exposed Shell Bottom. Most fishing pressure occurs on the Reef Bottom type.

Complete Calcasieu Lake oyster landings data via the LDWF Trip-Ticket program indicated that there were 82,896 sacks reported landed in the 2010-11 season (Table 7.5). This is a decrease from the previous year. It is estimated that about 58% or 48,079 sacks, of the total harvest came from GA30 (derived from CSA7 boat count harvest estimates).

GA31 has 1,031,976.2 sacks of sack oysters available, this is up 115.5% over the 2010 assessment. At this time there is no season on GA31. The 2010 stock assessment of GA31was completed in August 2010 which was after the statewide stock assessment was published; therefore the oyster stock data for GA31was not included in last year's report. No oyster season was set for GA31 this past year.

Seed Oysters

Seed oysters increased in GA29 by 518.3% from the 2010 assessment, but were still down by 80.3% from the short term average (2006-10) (Table 7.4). Seed oysters decreased in GA30 by 49.0% from the 2010 assessment, but were still up by 14.8% from the short term average (2006-10) (Table 7.4). Seed oysters in GA31had a slight drop of 6.9% from the 2010 assessment (Table 7.4)

Hydrology

Average water temperatures for May and June were 24.8^{o}C and 29.2^{o}C respectively and were above the long term average (LTA) of 1970-2010 (Table 7.7). The average water temperature during the oyster assessment was 31.0^{o}C which is slightly higher that the LTA of 29.5^{o}C.

Average salinities (in parts per thousand - ppt) for May and June were 18.5ppt and 16.8ppt respectively; this is much higher than the LTA for the same months (Table 7.7). The average salinity during the oyster assessment was 19.2ppt which is above the LTA of 15.5ppt; this is due to low amounts rainfall since July of last year. Rainfall during the timeframe of July 2010 through present at the Lake Charles Airport is -22.25 inches (from the NOAA Lake Charles weather website).

Disease, Fouling Organisms, and Predators

Hooked mussels continue to be about the same as 2010 assessment in GA29 and 30. There were no hooked mussels in the GA29 samples. Increased fishing pressure in that area may have served to reduce mussel numbers. Hooked mussels were present in GA30 averaging 200.7 per sample station and is slightly higher than last year's 168.3 per station. Hooked mussels were present in GA31 averaging 613.5 per sample station. The high numbers in GA31 could be attributed to no oyster dredge activity on the reefs.

There were a total of 20 Southern Oyster drills (*Stramonita haemastoma*), a predatory marine snail, collected during this assessment in GA29. This is higher than last the 2010 number of 13 oyster drills. There have been very few oyster drills present in either the meter square or dredge samples for a long time; in looking back at the dredge data since 2005, they started increasing in 2009 with a total collected in 2011 of 323 (Figure 7.9). There were no oyster drills collected in GA30 or 31.

There was a total of 298 unidentified mud crabs found in the samples from all three growing areas. No other species of concern were found.

Future assessments
All the areas open to oystering in GA29, 30 and 31 that likely have oysters have had bottom surveys completed. The upper half of Calcasieu Lake hasn't been surveyed, but is not available at this time to oyster fishing because of LDHH closure. The upper area of Sabine Lake probably has few if any oysters and will not need bottom surveying at this time.

<u>2010-11 Oyster Season</u>
The Louisiana Wildlife and Fisheries Commission started the 2010-11 season with GA30 opening October 15th with a limit of 20 sacks/boat/day, then GA29 opened along with GA30 in November 15th with the limit set at 10 sacks/boat/day for both growing areas (Table 7.8).

With the low numbers of available oysters on the eastern oyster areas of the state, demand continues to be high. This has caused continued high fishing pressure in Calcasieu Lake with an average of 129 vessels landing oysters per month in the 2010-11 oyster season (Figure 7.5). The highest number of boats landing oysters from the 2010-11 season in Calcasieu Lake was March 2011 at 151.

With the continued increase in fishing pressure mentioned above has come a corresponding increase in harvest from 19,327 in the 2005-06 season to one of the highest on record at 137,074 in the 2009-10 season, with the landings in the 2010-11 season being 82,896 sacks (Table 7.5).

The completed bottom survey of GA29 showed very little added Type IIIB acreage added to GA29 by the additional area that LDHH opened in early March.

The heavy harvest pressure appears to be affecting the availability of oysters in GA29 where most of the harvest has occurred in past years. Dredge samples in GA29 taken through the season continued to show very little oyster resource available as low catch per unit effort (CPUE) persisted (Figure 7.8). Due to low resource and enforcement issues GA29 was closed in March with GA30 remaining open until the end of April (LDWF News Release 3/22/2011 and Table 7.8).

Lack of rainfall since last summer allowed harvest for 100% of the season in GA29 and 95% of the season in GA30. The amount of days that GA30 was open was unprecedented since the inception of the river stage closures (Table 7.6).

For the three seasons 2005-2008 (Table 7.8), attempts were made to urge more fishermen to utilize the resource in GA30, but to no avail. Oysters in GA30 have not been fished in that area and many fishermen report that those oysters are less desirable for the market. Since this was the case, the 2008-09 and 2009-10 seasons, both GA29 and GA30 were opened at the same time. The LWFC opened the first month of oystering to just GA30, with the shortage of oysters in GA29 and the closure of GA29 in March, the oyster fishermen were forced to fish GA30 to a much greater degree. It was estimated that about 58% of the total harvest came from GA30.

<u>2011-12 Oyster Season</u>

SB73 passed and became Act 329 and at this time will be effective for the 2011-12 season. This Act will limit the number of oyster fishermen to 126 for Calcasieu Lake. Unless something changes this Act in the future, it will remain in effect until 2014.

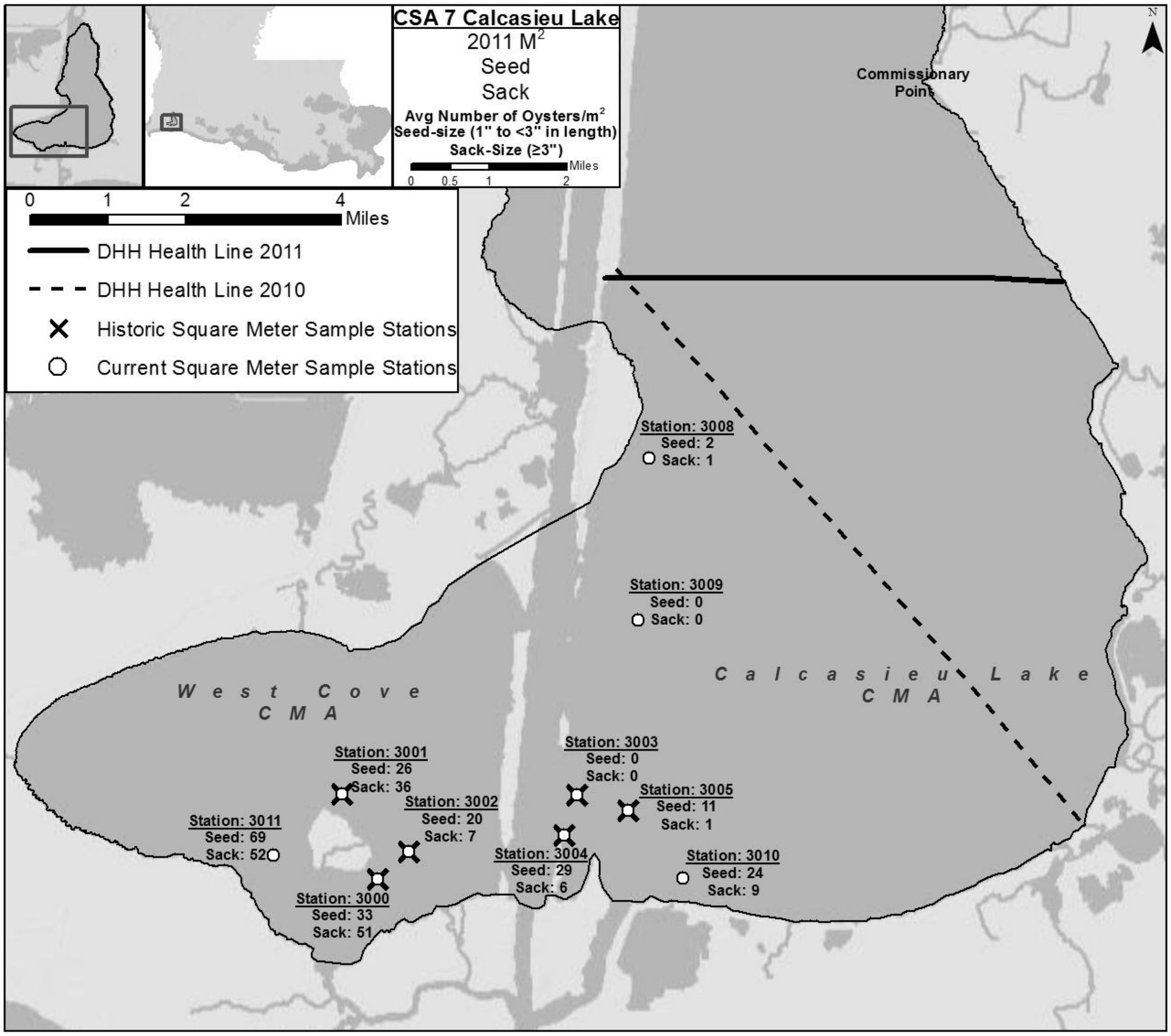


Figure 7.1. The Calcasieu Lake Public Oyster Area indicating the two conditional management areas (one east of the Calcasieu Lake Ship Channel and one west of the channel), as well as the 2011 oyster square meter sample stations.

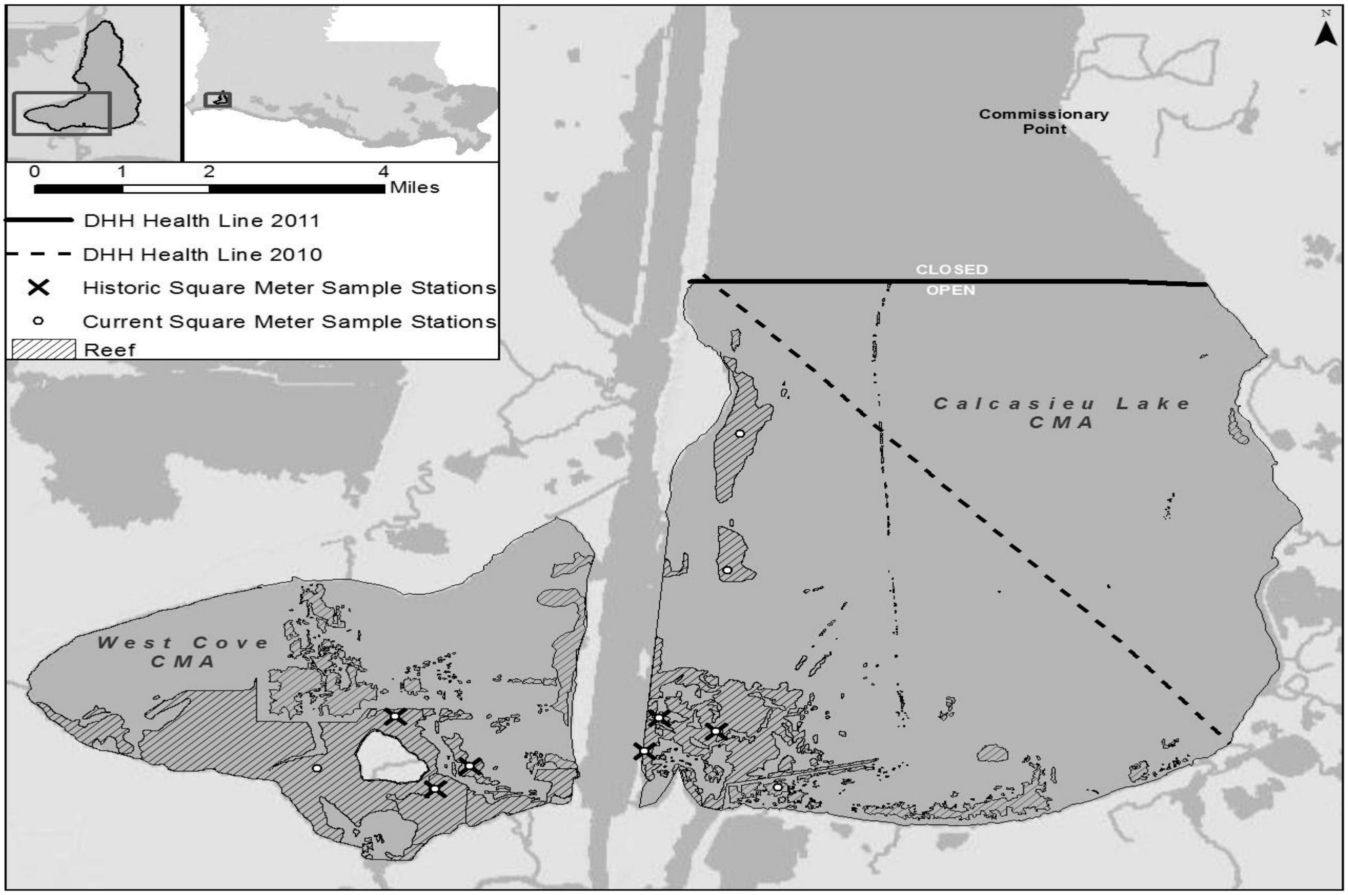


Figure 7.2. Oyster habitat (reef) coverage within the Calcasieu Lake Public Oyster Area as delineated by recent side-scan sonar projects in 2008 and 2011.

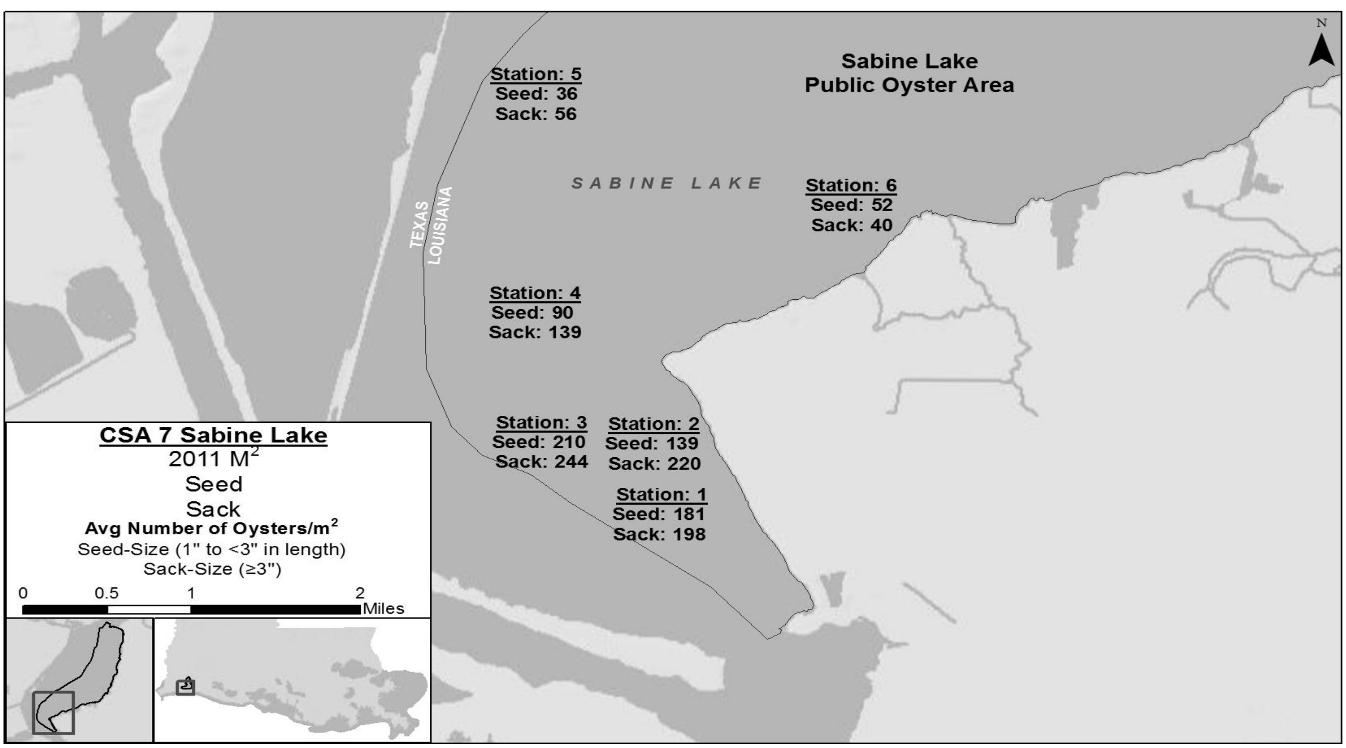


Figure 7.3. The 2011 oyster square meter sampling stations and results within the Sabine Lake Public Oyster Area.

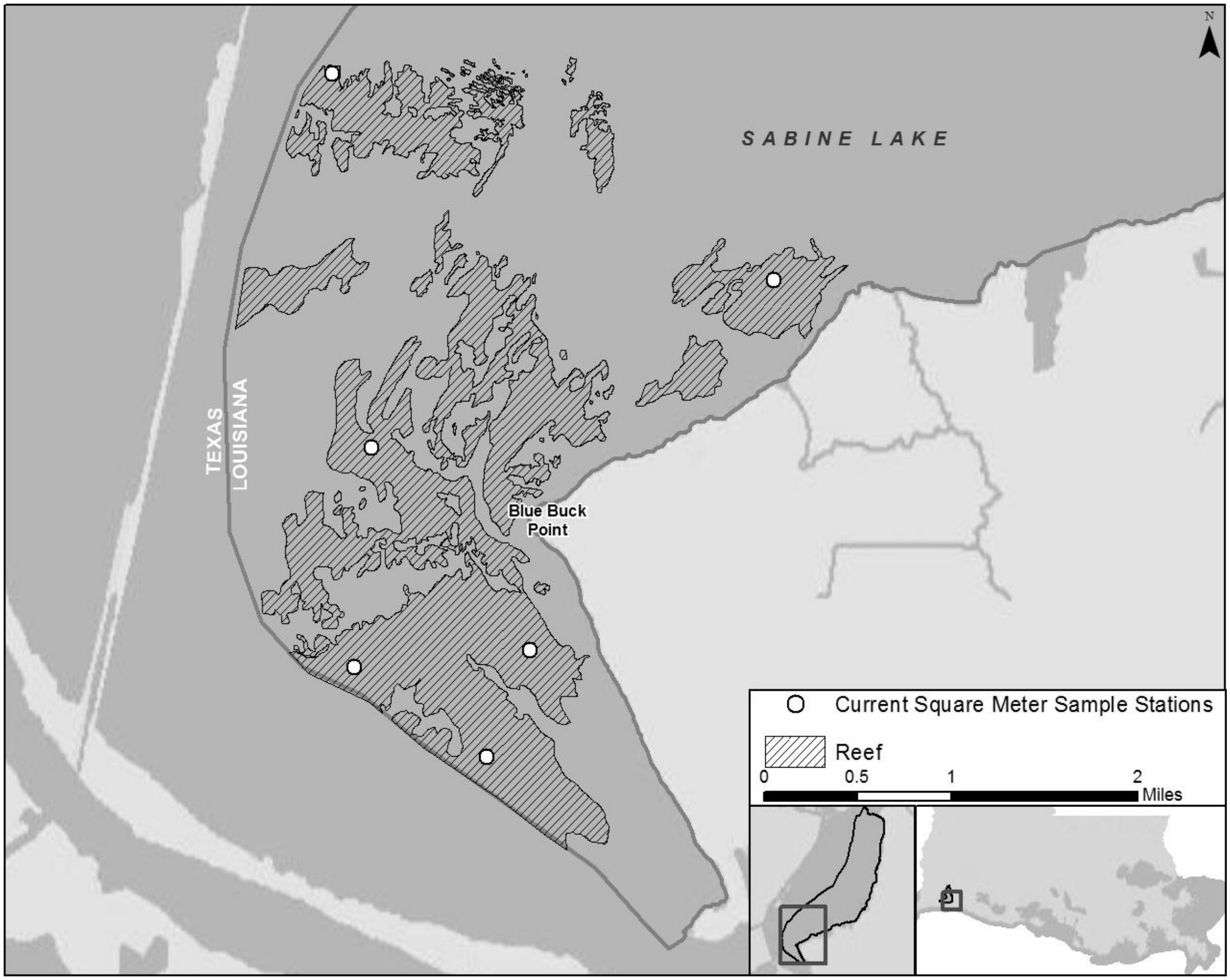


Figure 7.4. Oyster habitat (reef) as determined by the 2008 side scan sonar project

Table 7.1. 2011 Oyster Stock Assessment: Calcasieu Lake – GA29.

CALCASIEU LAKE - EASTSIDE (GA29) OYSTER STOCK ASSESSMENT
AUGUST 2011

TYPE IIIB – REEF
5,810,424.156 Square Meters (1,435.8 Acres)[1]

Oysters

Size	Station				Ave.
	BIG WASHOUT	LITTLE WASHOUT	MID LAKE	'09 CULTCH PLANT	
Spat (<1")	0	150	17	15	9.10
Seed (1"-<3")	0	29	11	24	3.20
Sack (≥3")	0	6	1	9	0.80
No. of Replicates	5	5	5	5	

Availability of Oysters

No. of Spat Oysters:	52,874,859.82		
No. of Seed Oysters:	18,593,357.30	Sacks of Seed Oysters:	51,648.2
No. of Sack Oysters:	4,648,339.32	Sacks of Sack Oysters:	25,824.1
		Total:	77,472.3

TYPE IIIB – EXPOSED SHELL
2,142,791.190 Square Meters (529.5 Acres)[1]

Oysters

Size	Station		Ave.
	NINE MILE	LONG POINT	
Spat (<1")	0	0	0.00
Seed (1"-<3")	0	2	0.20
Sack (≥3")	0	1	0.10
No. of Replicates	5	5	

Availability of Oysters

No. of Spat Oysters:	0		
No. of Seed Oysters:	428,558.24	Sacks of Seed Oysters:	1,190.4
No. of Sack Oysters:	214,279.12	Sacks of Sack Oysters:	1,190.4
		Total:	2,380.8

OYSTERS AVAILABLE IN GA29

Sacks of Seed Oysters: 52,838.6 **Sacks of Sack Oysters: 27,014.5**

1 – Area listed is from LDWF contracted assessments from Encos, Inc. from 2008 and Bio-West from 2011.

Table 7.2. 2011 Oyster Stock Assessment: Calcasieu Lake – GA30.

CALCASIEU LAKE – WEST COVE (GA30) OYSTER STOCK ASSESSMENT
AUGUST 2011

TYPE IIIB – REEF
4,530,819.672 Square Meters (1,119.6 Acres)[1]

Oysters

Size	Station		Ave.
	SOUTHEAST RABBIT ISLAND	WEST COVE TRANSPLANT	
Spat (<1”)	22	43	6.50
Seed (1”-<3”)	33	20	5.30
Sack (≥3”)	51	7	5.80
No. of Replicates	5	5	

Availability of Oysters

No. of Spat Oysters:	29,450,327.87		
No. of Seed Oysters:	24,013,344.26	Sacks of Seed Oysters:	66,703.7
No. of Sack Oysters:	26,278,754.10	Sacks of Sack Oysters:	145,993.1
		Total:	212,696.8

TYPE IIIB – EXPOSED SHELL
9,178,997.124 Square Meters (2,268.2 Acres)[1]

Oysters

Size	Station		Ave.
	NORTHEAST RABBIT ISLAND	WEST RABBIT ISLAND	
Spat (<1”)	16	34	5.00
Seed (1”-<3”)	26	69	9.50
Sack (≥3”)	36	52	8.80
No. of Replicates	5	5	

Availability of Oysters

No. of Spat Oysters:	45,894,985.62		
No. of Seed Oysters:	87,200,472.68	Sacks of Seed Oysters:	242,223.5
No. of Sack Oysters:	80,775,174.69	Sacks of Sack Oysters:	448,751.0
		Total:	690,974.5

OYSTERS AVAILABLE IN GA30

Sacks of Seed Oysters: 308,927.2 **Sacks of Sack Oysters: 594,744.1**

OYSTERS AVAILABLE IN CALCASIEU LAKE

Sacks of Seed Oysters: 361,176.8 **Sacks of Sack Oysters: 621,758.6**

1 – Area listed is from LDWF contracted assessments from Encos, Inc. from 2008 and Bio-West from 2011.

Table 7.3. 2011 Oyster Stock Assessment: Sabine Lake – GA31.

SABINE LAKE (GA31) OYSTER STOCK ASSESSMENT
AUGUST 2011

TYPE IIIB – REEF
4,212,739.620 Square Meters (1,041.0 Acres)[1]

Oysters

Size	Station				Ave.
	SL1	SL2	SL3	SL4	
Spat (<1")	95	49	82	33	12.95
Seed (1"-<3")	181	139	210	90	31.00
Sack (≥3")	198	220	244	139	40.05
No. of Replicates	5	5	5	5	

Availability of Oysters

No. of Spat Oysters:	54,554,978.081		
No. of Seed Oysters:	130,594,928.22	Sacks of Seed Oysters:	362,763.7
No. of Sack Oysters:	168,720,221.78	Sacks of Sack Oysters:	937,334.6
		Total:	1,300,098.3

TYPE IIIB – EXPOSED SHELL
1,774,530.570 Square Meters (438.5 Acres)[1]

Oysters

Size	Station		Ave.
	SL5	SL6	
Spat (<1")	31	22	5.30
Seed (1"-<3")	36	52	8.80
Sack (≥3")	56	40	9.60
No. of Replicates	5	5	

Availability of Oysters

No. of Spat Oysters:	9,405,012.02		
No. of Seed Oysters:	15,615,869.02	Sacks of Seed Oysters:	43,377.4
No. of Sack Oysters:	17,035,493.47	Sacks of Sack Oysters:	94,641.6
		Total:	138,019

OYSTERS AVAILABLE IN GA31

Sacks of Seed Oysters: 406,141.1 **Sacks of Sack Oysters: 1,031,976.2**

1 – Area listed is from LDWF contracted assessments from Encos, Inc. from 2008.

Table 7.4. Calcasieu Short Term Assessments and Percentage Change. Data presented are in sacks.

ASSESSMENTS BY CONDITIONAL MANAGED AREA						
	SACK OYSTERS (≥ 3")			SEED OYSTERS (< 3")		
YEAR	EASTSIDE	WESTCOVE	SABINE	EASTSIDE	WESTCOVE	SABINE
2006	140,876.1	98,069.2	NA	159,298.4	65,379.5	NA
2007	548,333.3	114,414.1	NA	598,181.8	337,566.5	NA
2008	752,061.9	142,199.9	NA	449,720.0	212,483.3	NA
2009[1]	612,687.3	711,613.6	NA	191,435.5	422,520.6	NA
2010[1]	23,540.1	689,375.7	478,985.9	8,545.3	605,983.5	436,409.4
AVERAGE	**415,499.7**	**351,134.5**	**478,985.9**	**281,435.8**	**328,786.7**	**436,409.4**
2011[2]	27,014.5	594,744.1	1,031,976.2	52,831.9	308,927.2	406,141.1
% CHANGE FROM AVE.	-93.5	+69.4	+115.5	-81.2	-6.0	-6.9
% CHANGE FROM 2010	+14.8	-13.7	+115.5	+518.3	-49.0	-6.9

1 - assessed using updated reef acreage from ENCOS (3,907.1) in 2008.
2 - assessed using updated reef acreage from ENCOS (2008) and Bio-West (2011).

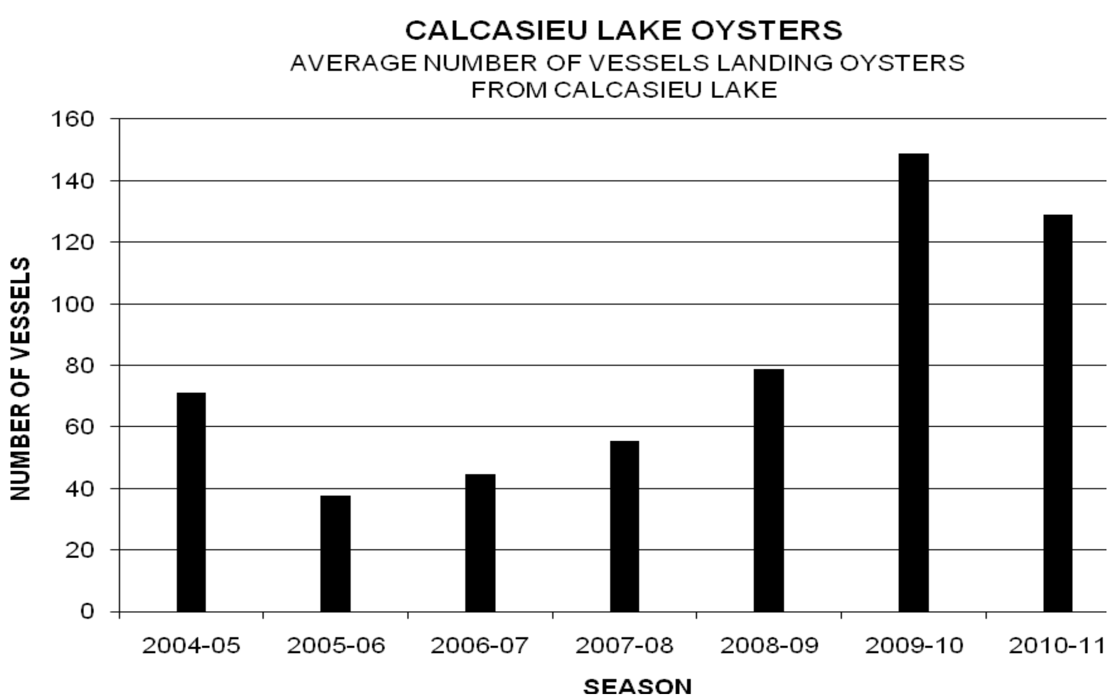


Figure 7.5. Monthly average of boats landing oysters from Calcasieu Lake (GA29 and 30).

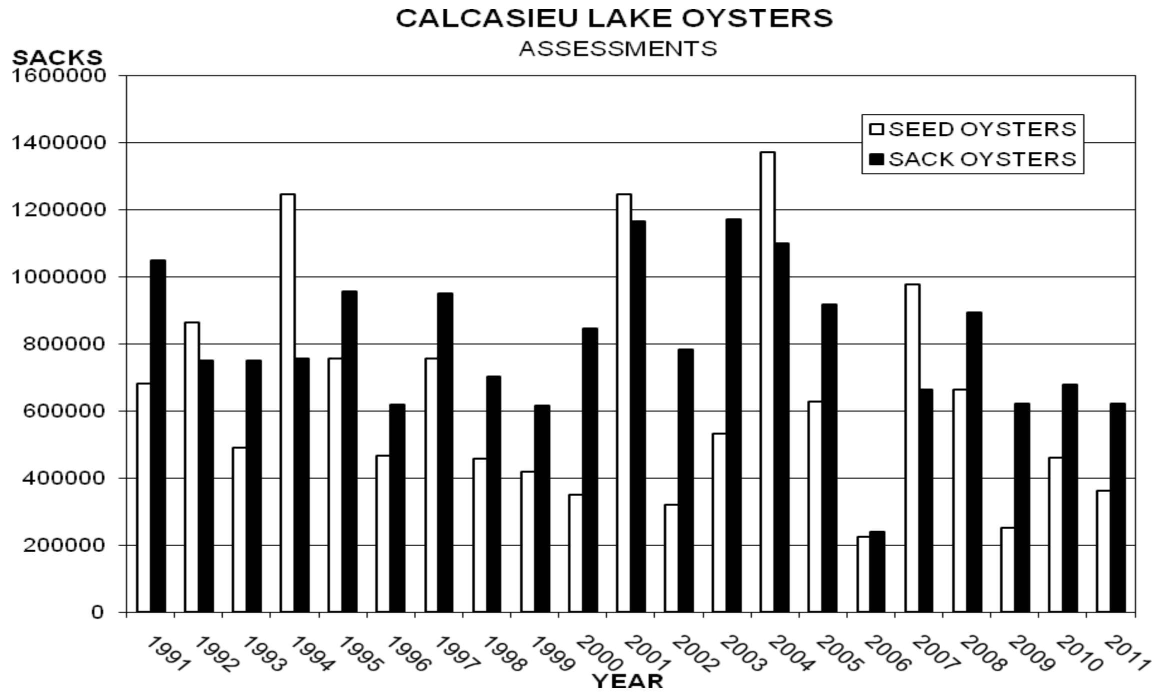


Figure 7.6. Calcasieu Lake Available Seed and Sack Oysters.

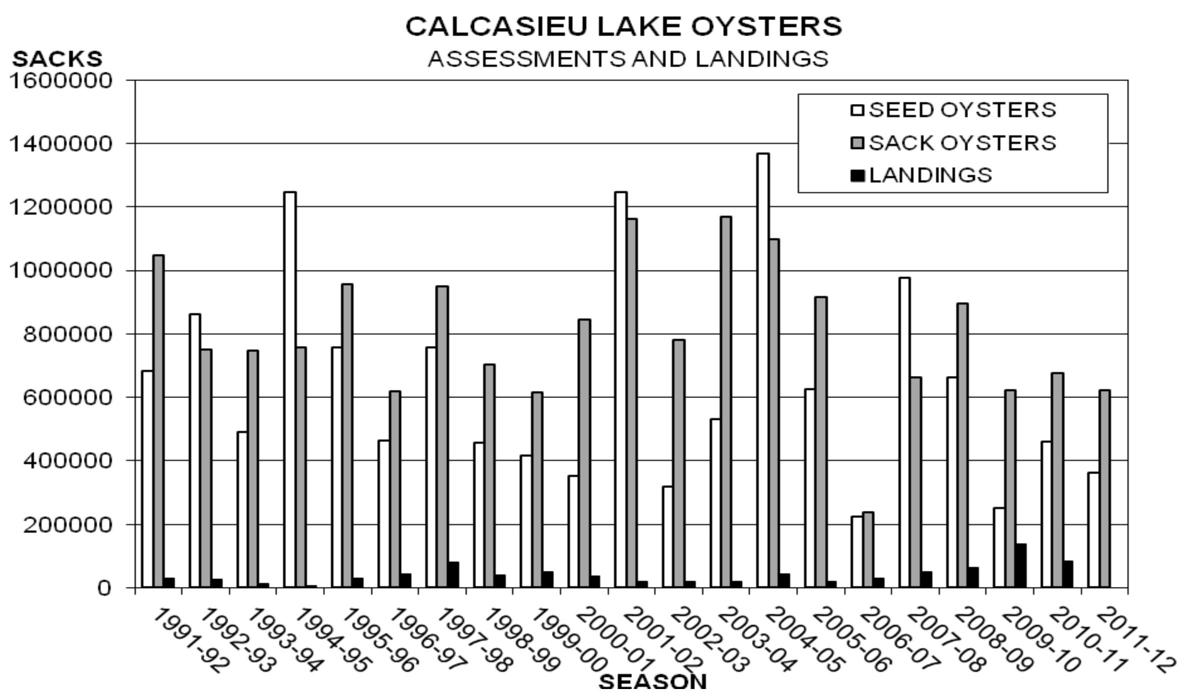


Figure 7.7. Calcasieu Lake Available Oysters and Landings.

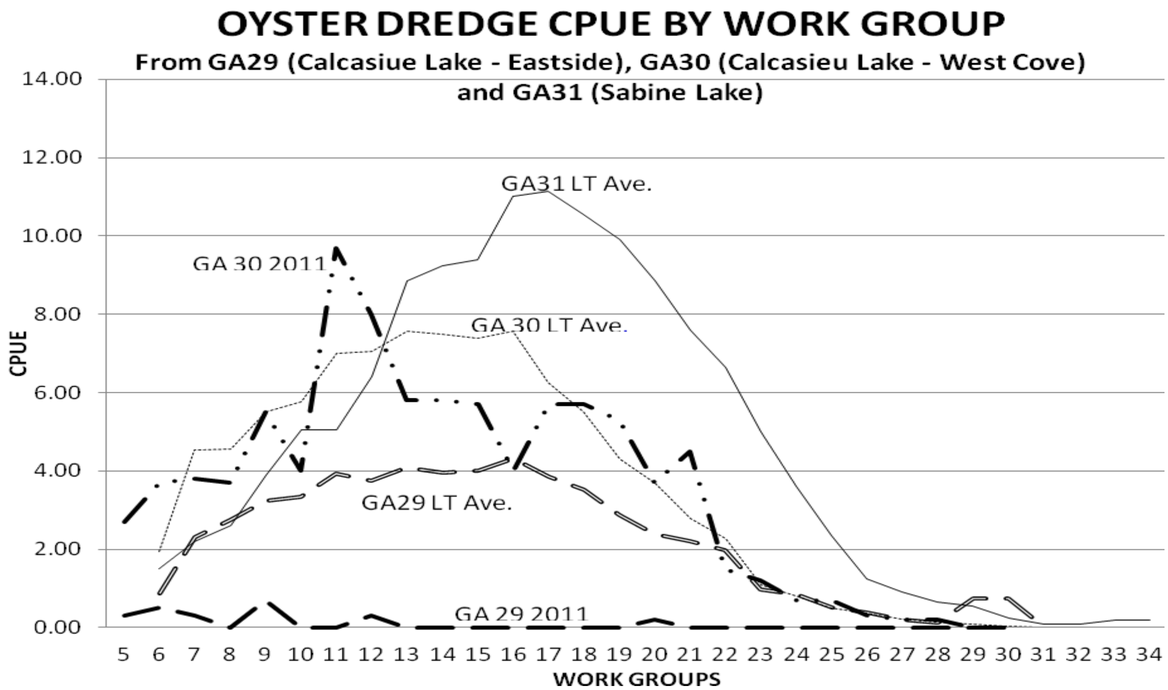


Figure 7.8. Dredge sample comparison (GA31 LT Ave. is the just for 2010 and 2011 data).

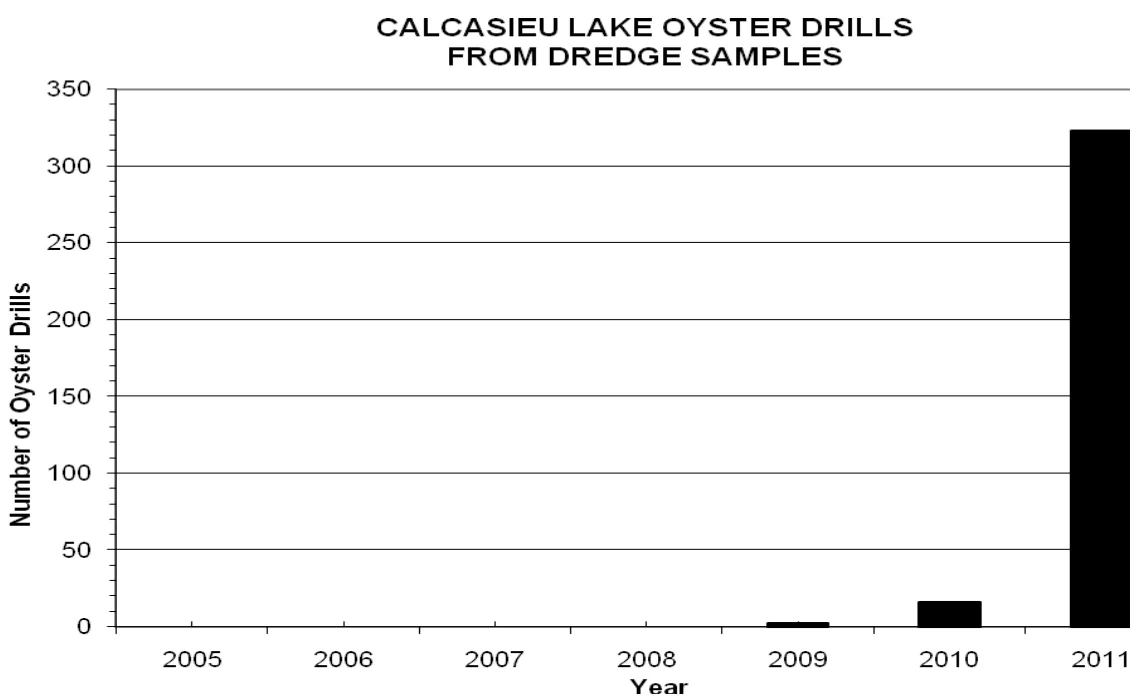


Figure 7.9. Average of all Oyster drills taken in all samples from Calcasieu Lake (2011 is only January – June).

Table 7.5. Historical Stock Assessments and Landings (in sacks).

SEASONS	STOCK ASSESSMENT		ESTIMATED SACKS HARVESTED
	MARKETABLE	TOTAL	
1963	-	-	210,160
1967-74	-	-	NO COMMERCIAL
1975-76	142,726	441,183	40,000
1976-77	694,420	869,475	100,000
1977-78	483,673	621,885	141,976
1978-79	-	-	75,000
1979-80	676-333	979,613	125,000
1980-81	355,664	705,117	150,000
1981-82	608,110	988,575	-
1982-83	-	-	50,000-75,000
1983-84	-	-	150,000
1984-85	125,407	644,788	-
1985-86	315,160	537,760	27,400
1986-87	589,940	1,217,959	200,000
1987-88	796,950	2,703,647	125,000
1988-89	463,331	1,036,580	50,000
1989-90	172,046	640,892	40,000
1990-91	408,961	1,268,962	50,000
1991-92	1,048,882	1,731,367	31,383[1]
1992-93	749,915	1,612,736	27,328
1993-94	748,281	1,238,783	12,818
1994-95	756,525	1,246,480	6,134
1995-56	956,926	1,298,379	29,082
1996-97	618,767	1,083,866	43,441
1997-98	950,979	1,706,510	80,735
1998-99	702,371	1,160,115	39,202[2]
1999-00	614,145	1,032,117	58,960
2000-01	846,176	1,197,311	35,881
2001-02	1,163,750	2,409,482	21,297
2002-03	781,676	1,100,257	21,386
2003-04	1,169,997	1,700,663	18,196
2004-05	1,099,236	2,468,560	44,293
2005-06[3]	915,625	1,541,893	19,327
2006-07[4]	238,945	463,623	28,341
2007-08	662,747	1,638,496	49,529
2008-09	894,262	1,556,465	63,948[5]
2009-10[6]	621,006	873,099	137,074
2009-10[7]	1,398,437	1,972,920	
2010-11[8]	712,916	1,327,445	82,896

1 - STARTED USING DEALER REPORTS FOR LANDINGS.
2 - THE 1999 PORTION OF THE LANDINGS WAS DERIVED FROM PRELIMINARY TRIP TICKET DATA.
3 - HURRICAN RITE MADE LANDFALL ON 9/23/05 IN CAMERON PARISH, DELAYING SEASON OPENING, LIMITING THE NUMBER OF FISHERMEN AND BUYERS.
4 - A SEWAGE LINE BREAK IN BAYOU D'INDE CLOSED THE SEASON IN FOR THE ENTIRE MONTH OF APRIL, LIMITING THE LANDINGS.
5 - NO DATA WAS AVAILABLE FOR OCT.2008.
6 - ASSESSMENT USING THE REGULAR REEF ACREAGE.
7 - ASSESSMENT USING THE UPDATED REEF ACREAGE FROM ENCOS (2008).
8 - USING THE UPDATED REEF ACREAGE (2008) AND USING FIVE REPLICATES INSTEAD OF TWO.

Table 7.6. Calcasieu Lake Percent of Season Days Open.

SEASON		TOTAL DAYS	LOWER CALCASIEU LAKE CMA GA29		WEST COVE CMA GA30	
			OPEN DAYS	PERCENTAGE	OPEN DAYS	PERCENTAGE
1991-92		199	114	57	114	57
1992-93*		165	137	83	76	46
1993-94		181	146	81	84	46
1994-95		181	90	50	9	5
1995-96		188	175	93	115	61
1996-97		197	149	76	114	58
1997-98		197	139	71	96	49
1998-99		197	135	69	120	61
1999-00		197	197	100	182	92
2000-01		198	180	95	106	53
2001-02		198	158	80	61	31
2002-03		198	146	74	66	33
2003-04		199	172	87	126	63
2004-05		198	168	85	68	34
2005-06	LCLCMA	198	187	94		
	WCCMA	205			165	40
2006-07	LCLCMA	181	118	65		
	WCCMA	197			70	35
2007-08	LCLCMA	182	165	91		
	WCCMA	199			131	66
2008-09	LCLCMA	198	183	92		
	WCCMA				125	63
2009-10	LCLCMA	198	157	79		
	WCCMA				80	40
2010-11	GA29	131	131	100		
	GA30	196			186	95

* 92-93 SEASON STARTED USING CALCASIEU RIVER GAUGE AT KINDER FOR DHH CLOSURES.

Table 7.7. Calcasieu Lake Salinity and Temperature.

2011 HYDROLOGY								
	GA29		GA30		GA31		LONG TERM (CALCASIEU LAKE)[1]	
MONTH	AVE. SAL.	AVE. TEMP.	AVE. SAL.	AVE. TEMP.	AVE. SAL.	AVE. TEMP.	AVE. SAL.	AVE. TEMP.
MAY DREDGE SAMLES	15.8	26.8	17.6	22.7	22.2	24.9	10.7	24.5
JUNE DREDGE SAMPLES	14.6	29.1	17.3	28.2	18.5	30.3	11.1	28.1
AUGUST SQ. MTR. ASSESSMENT	20.8	30.7	17.6	31.2	19.3	31.0	15.5	29.5

1 – Longterm is only available from Calcasieu Lake, from 16'trawl data (1970-2010).

Table 7.8. Calcasieu Lake Oyster Season Dates.

SEASON		REGULAR SEASON DATES OPEN DATE	CLOSED DATE	TOTAL DAYS	DHH HEALTH CLOSURES CAL. L. CMA DAYS OPEN	DAYS CLOSED	WEST COVE CMA DAYS OPEN	DAYS CLOSED	EXTENDED SEASON DATES OPEN DATE	CLOSED DATE	TOTAL DAYS	DHH HEALTH CLOSURES CAL. L. CMA DAYS OPEN	DAYS CLOSED	WEST COVE CMA DAYS OPEN	DAYS CLOSED	TOTAL DAYS IN SEASON
1989-90		11-15	3-15	121	79	42	79	42	3-16	4-30	46	40	6	40	6	165
1990-91		11-15	3-1	147	95	52	95	52	3-30	4-20	34	20	0	0	0	181
1991-92		10-15	3-1	139	69	70	69	70	3-2	4-30	60	45	15	15	15	199
1992-93[1]		10-15	3-1	138	123	15	76	62	3-8	4-3	27	14	13	13	27	165
1993-94		11-1	3-1	121	94	27	61	60	3-2	4-30	60	52	8	8	7	181
1994-95[2]		11-1	3-1	121	69	52	9	112	3-2	4-30	60	21	39	39	60	181
1995-96		10-16	3-1	138	125	13	80	58	3-2	3-31	30	30	0	0	0	-
									4-11	4-30	20	20	0	0	15	188
1996-97		10-16	5-1	197	149	48	83	114	-	-	-	-	-	-	-	197
1997-98		10-16	4-30	197	139	58	101	96	-	-	-	-	-	-	-	197
1998-99[3]		10-16	4-30	197	135	62	77	120	-	-	-	-	-	-	-	197
1999-00		10-16	4-30	197	197	0	182	15	-	-	-	-	-	-	-	197
2000-01		10-15	4-30	198	180	18	106	92	-	-	-	-	-	-	-	198
2001-02		10-15	4-30	198	158	40	61	137	-	-	-	-	-	-	-	198
2002-03		10-15	4-30	198	146	52	66	132	-	-	-	-	-	-	-	198
2003-04		10-15	4-30	199	172	27	126	73	-	-	-	-	-	-	-	199
2004-05		10-15	4-30	198	168	30	68	130	-	-	-	-	-	-	-	198
2005-06	LCLCMA	10-15	4-30	198	187	11			-	-	-	-	-	-	-	198
	WCCMA	10-8	4-30	205			165	40	-	-	-	-	-	-	-	205
2006-07	LCLCMA	11-1	4-30	181	118	63			-	-	-	-	-	-	-	181
	WCCMA	10-16	4-30	197			70	127	-	-	-	-	-	-	-	197
2007-08	LCLCMA	11-1	4-30	182					-	-	-	-	-	-	-	181
	WCCMA	10-15	4-30	199					-	-	-	-	-	-	-	198
2008-09	LCLCMA	10-15	4-30	198	183	15			-	-	-	-	-	-	-	198
	WCCMA						125	73	-	-	-	-	-	-	-	
2009-10	GA29	10-15	4-30	198	157	41			-	-	-	-	-	-	-	198
	GA30						80	118	-	-	-	-	-	-	-	
2010-11	GA29	11-15	3-25[5]	131	131	0			-	-	-	-	-	-	-	131
	GA30[4]	10-15	4-30	196			186	10	-	-	-	-	-	-	-	196

1 - STARTING WITH THE 92-93 SEASON CALCASIEU LAKE WAS SPLIT INTO TWO UNITS: CAL. LAKE CMA (W/ RIVER STAGE CLOSURE @ 12 FT.) AND WEST COVE CMA (W/ RIVER STAGE CLOSURE @ 7 FT.).
2 - DHH CLOSED THE CAL. LAKE CMA (FROM 11/1-12/10/94) AND WEST COVE (FROM 11/1-1/28/95) WITH A PRECAUTIONARY (POSSIBLE LEAD CONTAMINATION) CLOSURE.
3 - DURING THIS SEASON THE RIVER LEVEL CRITERIA IN THE CAL. LAKE CMA CHANGED FROM 12 TO 13.5 FT.
4 - FROM 10-15 THROUGH 11-14, THE SACK LIMIT WAS 20; SACK LIMIT REVERTED TO 10 FOR THE REMAINDER OF THE SEASON IN BOTH GROWING AREAS

Project Title: *Perkinsus marinus* evaluation for managing Louisiana's public and private oyster grounds.

Principal Investigator: Dr. John Supan
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Background and Motivation

Louisiana's public oyster grounds, particularly east of the Mississippi River, are the source of seed oysters for private leaseholders. Louisiana generally leads the nation in oyster production, with up to 80% produced on private leases historically. Therefore, the condition and productivity of the public seed grounds sets the pace for private production; when seed is lacking, so is private production (Berrigan et al. 1991).

During past seasonal openings of the public grounds during September, harvesters noticed increasing mortality in sizes greater than two inches. Collaborative efforts between the Department of Wildlife and Fisheries and the Louisiana Sea Grant College Program have identified Dermo. (*Perkinsus marinus*) as the potential cause of oyster mortality (LDWF, 1996) and initiated an annual Dermo Advisory Program for oyster leaseholders.

Results of successive samplings on nine stations east of the river and in Hackberry Bay showed high infection intensity and prevalence at most stations during drought years and lower infection during wet years. Although past population density surveys conducted by LDWF have revealed high concentrations of oysters at sampling stations east of the river, they are predominantly in the seed-size range of less than two inches. However, seed oyster samples were not present at many sample sites during 2011. Many leaseholders have experienced high mortalities of bedded seed concurrent with high salinities and temperatures on their bedding grounds.

Therefore, the latest year-class of seed oysters available for bedding on leases set among existing oysters that are highly infected with *Perkinsus* will exhibit high mortalities with rising temperature and salinity during the following summer. It is safe to say that more losses will occur during future bedding operations.

Objectives

The objectives of this project are:

(1) to conduct *Perkinsus* analyses on sack and seed oysters collected from LDWF sampling stations during their annual population density evaluations; and,

(2) to develop a database for assisting in the management of the public grounds by LDWF and to develop and continue a Dermo Advisory Program for oyster leaseholders.

Approach

Seed and sack oysters were collected by LDWF personnel from ten stations during the annual sampling of the public grounds, including nine stations east of the river and Hackberry Bay. Samples were taken to the Sea Grant Oyster Hatchery for subsequent analyses.

Perkinsus assays were conducted using oyster rectal tissue in Ray's Fluid Thioglycollate Media (RFTM) with a 7-14 day incubation period (Ray, 1966), and ranked according to intensity of infection by a 0-5 evaluation scale (Mackin 1962). Fifteen of each size range of oysters (seed [<1 inch]: market-size [>3 inches]) were analyzed, unless otherwise noted in the Table 1.

Final laboratory results were forwarded to LDWF for incorporation into its database for oyster management decision making and for the continuation of the Dermo Advisory Program at the Oyster Sentinel website.

Results

The Dermo infection intensity (weighted incidence) and percent prevalence at the ten stations during July 2011 are listed in Table 1. The 2010 data are listed in Table 2 for comparison. Dermo infections at most stations were greater in 2011 than in 2010. Infections were weighted incidence valued at 1 or greater, which is considered a dangerous or lethal value for any given oyster population, were found in market-size oysters at two sample sites, Three Mile Island, and Black Bay South. Many stations had few or no seed oysters in the sample.

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Table 1
2011 DERMO RESULTS
EAST OF RIVER & HACKBERRY BAY

	Seed			Market		
	Prevalence	Weighted Incidence		Prevalence	Weighted Incidence	
Bay Gardene	50%	0.5	n=8	66%	0.6	
Lonesome I.	75%	0.7	n=4	73%	0.7	
Mozambique Pt.	7%	0.03		20%	0.1	
N. Black Bay	no sample			no sample		
S. Black Bay	no sample			73%	1.0	
Bay Crabe	no sample			26%	0.4	
Telegraph Pt.	no sample			53%	0.7	
Cabbage Reef	no sample			10%	0.1	n=10
Three Mile	66%	0.6		73%	1.3	
Hackberry Bay	0%	0.0		53%	0.5	

Table 2
2010 DERMO RESULTS
EAST OF RIVER & HACKBERRY BAY

	Seed		Market	
	Prevalence	Weighted Incidence	Prevalence	Weighted Incidence
Bay Gardene	0%	0	33%	0.2
Lonesome I.	13%	0.1	0%	0
Mozambique Pt.	7%	0.03	20%	0.1
N. Black Bay	14%	0.1	20%	0.1
S. Black Bay	20%	0.1	0%	0
Bay Crabe	27%	0.1	14%	0.1
Telegraph Pt.	40%	0.4	33%	0.2
Cabbage Reef	27%	0.3	60%	0.3
Three Mile	20%	0.1	53%	0.3
Hackberry Bay	33%	0.2	13%	0.1

Mackin Scale used to determine incidence.

Levels of the oyster parasite *Perkinsus marinus* from Louisiana oysters west of the Mississippi River: Summer 2011

by

Thomas M. Soniat, Ph.D.

6 August 2011

Among the most significant causes of oyster mortality is the parasite *Perkinsus marinus* (formerly *Dermocystidium marinum*), which is responsible for annual mortality rates that exceed 50% in most populations of adult eastern oysters, *Crassostrea virginica*. *Perkinsus marinus* was described in 1950 by John Mackin, Malcolm Owen and Albert Collier as *Dermocystidium marinum* – hence the common name "Dermo" which is still in use (Mackin et al. 1950).

The discovery of the parasite was the result of investigations (funded by a consortium of oil companies and directed by Texas A&M University) of the impact of oil and gas activities on the Louisiana oyster industry (Mackin and Hopkins, 1962). Extensive studies were conducted on the effects of crude oil, bleed water, natural gas, drilling mud and seismographic surveys. It was ultimately realized that none of these pollutants or activities explained the widespread mortalities of oysters that were observed. It is now known that the parasite is a major cause of oyster mortality from Maine to Mexico (Soniat, 1996).

The critical environmental factors which favor the proliferation of the parasite are high water temperatures and high salinities. Thus infections are more intense in the late summer, on the seaward side of estuaries and during droughts. Drought conditions on the Gulf Coast are associated with the La Niña phase of El Niño Southern Oscillation; however, increases in prevalence (percent infection, PI) precede sharp increases in intensity (weighted incidence, WI) and epizootics of Dermo in Louisiana can lag La Niña events by about 6 months (Soniat et al., 2005). Management techniques to minimize disease and increase oyster harvest include moving infected oysters to lower salinity, early harvest of infected populations, and even freshwater diversion into high-salinity estuaries. Because of the key role of Dermo as a cause of oyster mortality, the success of oyster farming depends on the ability to manage oyster populations in the presence of high levels of disease (Soniat and Kortright, 1998).

The standard assay for determining the level of parasitism is the fluid thioglycollate method (Ray, 1966). A small piece of tissue is removed and assayed for disease after incubation in fluid thioglycollate and antibiotics for one week. *P. marinus* intensity is scored using a 0-to-5 scale developed by Mackin (1962), where 0 is no infection and 5 is an infection in which the oyster tissue is almost entirely obscured by the parasite. Calculations are made of percent infection (PI) and weighted incidence (WI), which is the sum of the disease code numbers divided by the total number of oysters in the sample. A WI of 1.5 could be considered a level at which disease-related mortalities are occurring. For example, Mackin (1962) claims: “a population of live oyster with a weighted incidence of 2.0 contains an intense epidemic, and more than half of the population may be in advanced stages of the disease, with all of the individuals infected.”

Oysters for the summer 2011 study were collected from 10 sites west of the Mississippi River. Samples were taken from one site in Lake Felicity (LF), one site in Lake Chien (LC), two sites in Sister Lake, two sites in Bay Junop, one site (Indian Point, IP) in Vermilion Bay, two sites in Lake Calcasieu, and one site in Sabine Lake (SL) The Sister Lake sites were Grand Pass (GP) and Old Camp (OC). The Bay Junop sites were Bayou DeWest (DW) and Buckskin Bayou (BB). The Lake Calcasieu sites were the 2009 Shell Plant (SP) and Northeast Rabbit Island (NE).

The length of 10 oysters was measured; mantle tissue was removed from each of the 10 oysters, incubated at room temperature in fluid thioglycollate for about a week, and assayed according to the standard Ray (1966) technique. The level of infection (disease code) was scored from 0 to 5, where 0 is no infection and 5 is near total coverage of the oyster tissue by the parasite. Weighted incidence (WI) was calculated by summing the disease code values and dividing by 10, the number of oysters in the sample.

Weighed incidence (WI) and percent infection (PI) results are shown in Table 1. WI values were 0.00 (Bayou DeWest), 0.00 (Buckskin Bayou), 0.07 (Grand Pass), 0.00 (Old Camp), 0.00 (Indian Point), 0.07 (Lake Chien), 0.00 (Lake Felicity), 0.50 (Shell Plant), 0.10 (Northeast Rabbit), and 1.13 (Sabine Lake). Salinity and disease levels were generally depressed, especially in areas that were likely affected by this year’s diversions of Mississippi River into the Atchafalaya Basin. The weighted incidence values are below critical levels, but there is some cause for concern in Lake Calcasieu and Sabine Lake. Most of the oysters from Lake Calcasieu were infected, and the Sabine Lake sample showed 100% infection and a weighted incidence

(1.13) approaching Mackin's (1962) critical level of 2.0.

As part of the Oyster Sentinel (www.oystersentinel.org) effort, samples in the Texas portion of lower Sabine Lake have been taken since 2006. Occasionally, disease levels there exceed critical levels. This is the first year that Dermo samples were taken in Sabine Lake for this study. It is recommended that a sample from Sabine Lake be a regular part of the Summer Dermo Study, since disease levels are more likely to impact oyster populations there than in any other part of Louisiana.

Table 1. Collection, environmental, oyster and disease data for oysters sampled from west of the Mississippi River: Summer 2011.

Station	**Date collected**	**Salinity (ppt)**	**Temperature (°C)**	**Oyster size range(mm)**	**Percent infection**	**Weighted incidence**
Bayou DeWest	7/27/11	7.2	29.7	82-107	0	0
Buckskin Bayou	7/27/11	4.7	29.1	75-111	0	0
Grand Pass	7/28/11	7.0	28.8	75-119	20	0.07
Old Camp	7/28/11	5.6	29.0	78-99	0	0
Indian Point	7/26/11	6.7	28.5	76-106	0	0
Lake Chien	7/28/11	5.3	29.1	75-99	10	0.07
Lake Felicity	7/28/11	18.2	29.0	70-91	0	0.00
Calcasieu Shell Plant	7/25/11	26.3	30.1	85-95	70	0.50
Northeast Rabbit	7/25/11	23.1	29.6	82-109	90	0.93
Sabine Lake	7/25/11	25.0	30.3	80-102	100	1.13

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